MACHINERY

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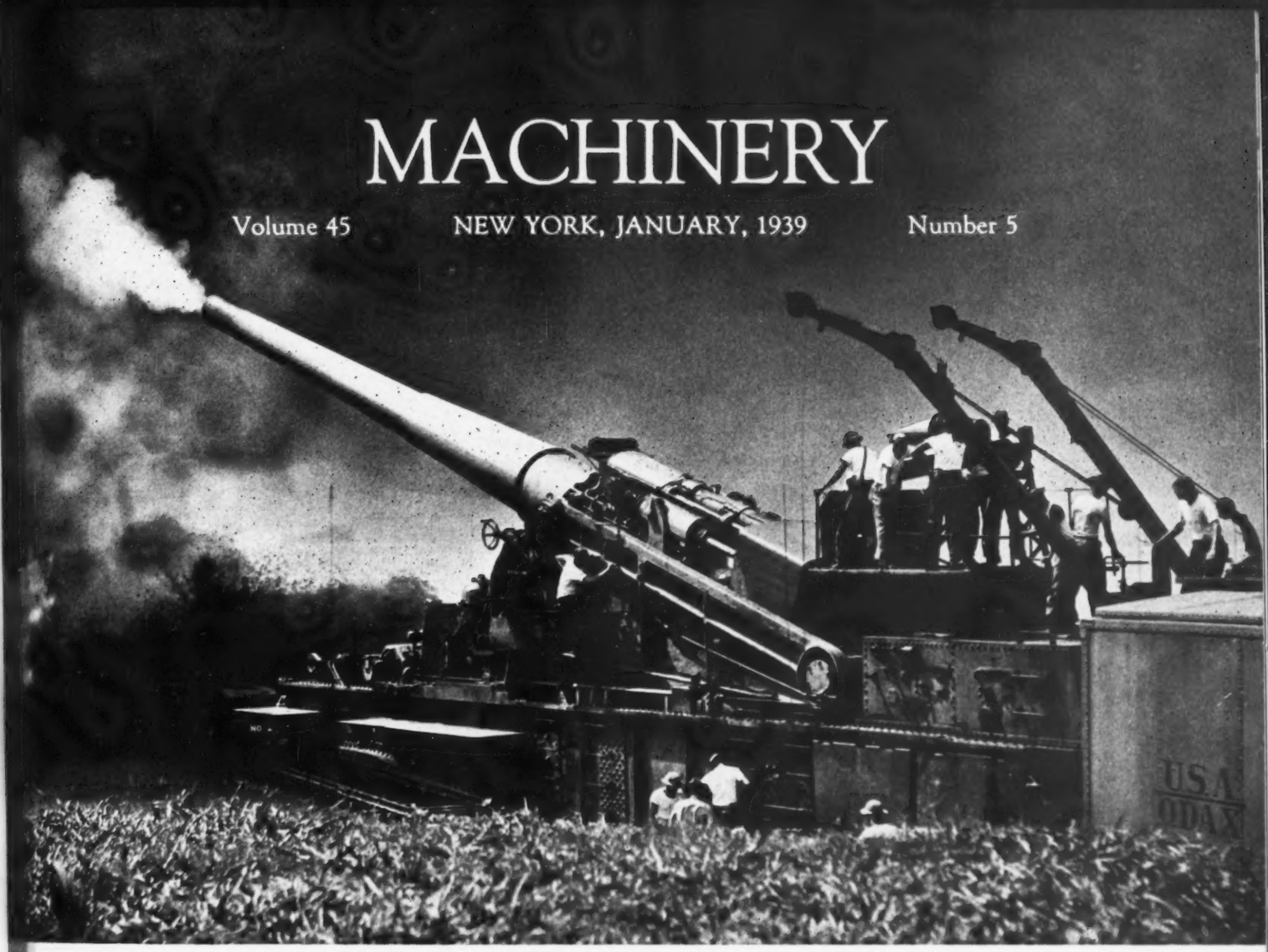


Machine Tools the Backbone of National Defense

By LOUIS JOHNSON
Assistant Secretary of War

MACHINE tools and the men who run them are of basic importance in winning a war. Not only are machine tools absolutely necessary for the production of guns, rifles, projectiles, tanks, airplanes, and battleships, but they are just as essential in building the machinery that prepares the explosives, manufactures clothing for the men in arms, or tills the soil for their food.

Our National Defense Program is, therefore, dependent upon the builders and users of machine tools to a very large degree. The whole-hearted cooperation that has been extended by the metal-working industry in developing and carrying out the Program is a source of gratification to the government officials who are responsible for its success. Not only have important industrial executives

contributed generously of their time and experience, but yeoman assistance has also been given by commercial associations and engineering bodies, including the National Machine Tool Builders' Association, the American Iron & Steel Institute, and the American Society of Mechanical Engineers.

The War Department has made tremendous advances during the last decade in the development of implements of war. A striking example of these advances is the Garand semi-automatic rifle which, in the hands of a single soldier, can deliver as many bullets as five to seven men could shoot with a Springfield rifle in World War days. But in the event of a major war, this rifle will be effective only if it can be turned out by metal-working plants in the required millions, with minimum delay.

The rifle consists of 72 parts, and for mass production requires 103 dies, 463 fixtures, 506 special cutting tools, 1320 working gages, and 1339 final inspection gages. Our National Defense Plans must make certain that this special equipment will be ready in case of war, and that private industrial plants will be thoroughly familiar with all operations involved in manufacturing this rifle.

What is true of the semi-automatic rifle is also true to some extent of our latest 75-millimeter guns, which have an effective range of 15,000 yards, as against 7500 yards in the World War, and of our latest howitzers, machine guns, anti-aircraft guns, tanks, and trucks. Any future war will be actually one between the metal-working industries of the nations involved.

Carrying out the Provisions of the National Defense Act

An important lesson learned from the World War was the folly of permitting the nation to drift into hostilities without first making provisions for the prompt mobilization of industry. In the World War, it took fourteen months to get our first division on the battle-front of Europe, and then it was largely equipped with artillery and ammunition that had been supplied by the Allies. Exasperating uncertainties and delays were experienced in getting supplies from American industry, due mainly to failure on the part of the Government to prepare itself and industry for the huge task thrust upon them.

The Sixty-sixth Congress, in 1920, decided that this situation should not occur again, and enacted the National Defense Act, which specifies that *"the Assistant Secretary of War, under direction of the Secretary of War, shall be charged with supervision of the procurement of all military supplies and other business of the War Department pertaining thereto, and the assurance of adequate provision for the mobilization of material and industrial organization essential to wartime needs."*

Great strides have been made in carrying out this legislation. The magnitude of the task may be appreciated from the fact that in the World War, the War Department found it necessary to purchase over 700,000 different items. Such a great diversification of supplies will not be required in any future war because of standardization and simplification, but there would still be several hundred thousand different items. The arsenals and government factories could only supply from 5 to 10 per cent of the requirements in a major war, and can therefore be considered only as highly important laboratories for developing production methods, establishing standards, determining costs, and training inspectors.

Objectives of the Industrial Mobilization Plan of 1936

To coordinate the requirements of both armed services of the nation, an Army and Navy Munitions Board was established in 1922. This board

developed the Industrial Mobilization Plan of 1936 which lays down broad policies and contains the organizational and control provisions considered necessary for mobilizing industry. This plan allocates manufacturing facilities to the Army and Navy as required, and also safeguards civilian needs. As far as possible, no manufacturing plant will be called upon to devote more than half of its facilities to wartime products. This will enable concerns to retain their peacetime trade while working on war orders, and thus will facilitate the return to normal manufacturing schedules when the war is over.

In the event of war, the Industrial Mobilization Plan provides for the creation, by the President, of the War Resources Administration, which will consist of civilians. The Army and Navy Munitions Board will then function as a liaison between industry and the War Resources Administration in matters pertaining to munitions requirements.

Over 10,000 Industrial Firms are Earmarked for Immediate Mobilization

The important task of developing plans for obtaining the large variety of Army supplies in the required amounts should war occur was delegated to the Planning Branch in the office of the Assistant Secretary of War. This work has been carried out to the point where the War Department knows what will be required in case of war, where the supplies can be procured, and the rate at which they will be available. Many of the things required by the armed forces in case of an emergency are of such a nature that they could be purchased on the open market on a competitive basis, as, for example, clothing, shoes, food, and bedding. Provisions for obtaining these supplies would not create a problem, and it is therefore to the procurement of the special wartime requirements, such as munitions, ordnance, and gas masks, that the activities of the Planning Branch have been specifically directed.

Over 20,000 industrial concerns have been surveyed and analyzed to determine their manufacturing facilities, and over 10,000 firms have already accepted definite schedules for the manufacture of specific items. The items already allocated comprise two-thirds of the war load in money value. Each concern has studied the product to be manufactured if mobilization day should arrive and has given an accurate estimate of the monthly output for a period of either one or two years. Concerns have made recommendations to facilitate manufacture, such as changes in design and modification of tolerances. Factories that are now producing toys will be prepared to manufacture bombs or fuses; factories devoted to the production of locomotives or agricultural implements will be engaged in the manufacture of artillery shells; and industrial plants making kitchen utensils will produce airplane metal stampings. The shops of the machine tool industry will, however, continue to produce machine tools.

In each case, the load of wartime products has been established with a view to enabling the plant to meet civilian needs as far as possible, bearing in mind the important factor that the morale of the country at large is of the utmost importance in a long conflict.

District Offices Maintain Constant Survey of Manufacturing Facilities

In assigning a war load to an industrial plant such factors are carefully considered as the manufacturing facilities, competence of the management, transportation facilities, and accessibility of raw materials. The 20,000 analyses of industrial plants were made largely through actual visits to plants on the part of the personnel of forty-nine district

offices that have been established by the Army throughout the nation. These district offices are constantly engaged in surveying industry, formulating procurement plans, and training reserve officers. As the facilities of industrial plants increase or decrease, the district offices notify the Planning Branch in Washington and records are revised accordingly.

Important industrialists serve these district offices in an advisory capacity—some as dollar-a-year men—so that men with a large amount of manufacturing experience behind them are always ready to impart practical knowledge to the military men and clerical personnel of the district offices responsible for carrying out the details of the plans. This close cooperation with manufacturing experts was of vital importance in developing the plans for National Defense.

The district offices maintain complete records of the industrial facilities in their districts, and know what the requirements of their districts would be on mobilization day. The district offices are therefore in a position to alter schedules in the various plants under their jurisdiction to meet unforeseen production difficulties that might occur after mobilization day.

Congress has Authorized the Expenditure of $10,000,000 to Familiarize Concerns with the Manufacture of Wartime Products

In order that concerns who have accepted wartime schedules for producing difficult items will have experience in producing the work before mobilization day occurs, the last Congress authorized the appropriation of $2,000,000 annually for a period of five years for the placing of "educational orders." This appropriation will be used to acquaint concerns with the manufacturing methods to be followed in producing semi-automatic rifles, recoil mechanisms for anti-aircraft guns, 75-millimeter shells, gas masks, and 60-inch seachlights. Firms to which these educational orders are given will be provided with a complete set of gages, dies, tools, jigs, fixtures, and any other special equipment necessary for turning out the work assigned to them. These tools and equipment will remain the property of the United States Government and will be retained in an arsenal when not in use, ready for immediate distribution in the event that war is declared.

Almost Seven Million Dollars Appropriated to Purchase Special Machinery During This Fiscal Year

Considerable machinery of a special nature is considered necessary immediately for use in arsenals and to prepare private manufacturing firms to meet the National Defense Plans. During the present fiscal year, $500,000 will be spent for final inspection gages; $2,025,000 for presses and other machinery required in the production of smokeless powder; $1,800,000 for the equipment, largely machine tools, required for manufacturing semi-automatic rifles; $1,000,000 for the equipment necessary for producing small arms ammunition; $500,000 for machinery, also mainly machine tools, needed for making the 0.50-caliber machine guns; $700,000 for arsenal equipment; and $300,000 for machinery to make gas masks. That makes a total of $6,825,000 to be expended for special machinery this year by the War Department.

Additional Duties Performed by the Various Divisions of the Planning Branch

The work of surveying the production facilities of industry, matching capacity to requirements, and distributing the wartime load has been assigned to the Allocation Division of the Planning Branch in the office of the Assistant Secretary of War. The Procurement Plans Division analyzes procurement plans and coordinates various activities; the Standards Division investigates designs and specifications, simplifies manufacturing practices and serves as a liaison with technical societies. Other divisions are concerned with administration, legal matters, raw materials, the construction and expansion of plants, economic problems, and other details.

In addition to the Planning Branch, there is a Current Procurement Branch, which supervises procurement and other business activities of the War Department. There is also an Army Industrial College which instructs annually a student body of approximately sixty officers from the Army, Navy, and Marine Corps in the problems of procurement and industrial mobilization. During each course, this Industrial College is addressed by many prominent industrial executives, so that they become acquainted with both the business and the production problems of industry.

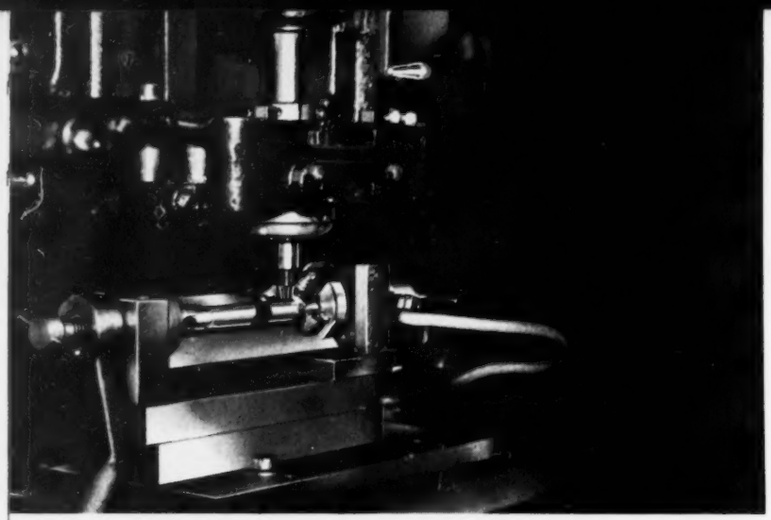
Since the plans developed for National Defense have been worked out by persons of broad experience in industry and in the military and naval services, they are fundamentally sound and practical. They will, of course, need constant study and frequent revision, and they must always be sufficiently flexible to meet any emergency. On the basis of their development, however, the nation may be assured that industry, and especially the metal-working branch, will know exactly what will be expected of it if mobilization day should arrive and be ready to fulfill its obligation speedily and without confusion.

LOUIS JOHNSON, Assistant Secretary of War

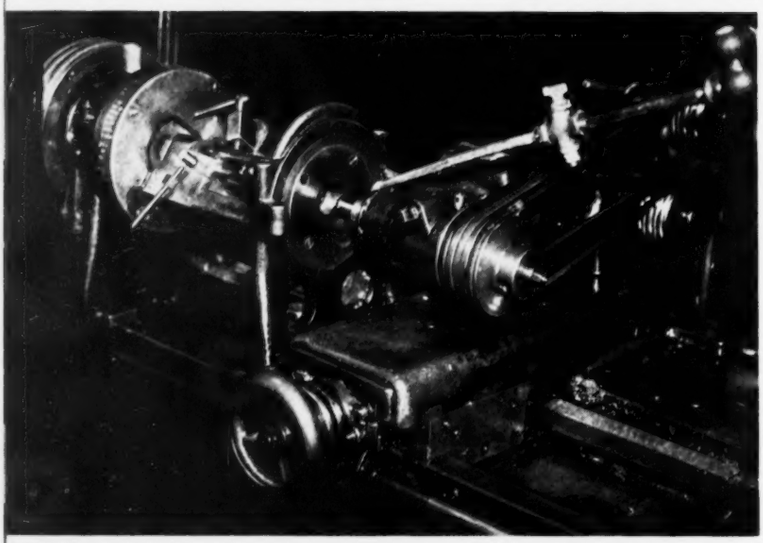
Colonel Louis Johnson became Assistant Secretary of War on June 28, 1937. He has had broad experience with both the military and industrial problems of National Defense. In 1917, he was commissioned a captain in the Infantry Section of the Officers Reserve Corps and served with the Eightieth Division at Camp Lee, Va. He participated with the Eightieth and the Fourth, Fifth and Ninetieth Divisions in the Meuse-Argonne Offensive. He was honorably discharged from the Army after his return to the United States, when he was appointed a major in the Infantry Section of the Officers Reserve Corps, and now holds the rank of Lieutenant-Colonel of Infantry.

In civil life, Colonel Johnson has taken an active part in the affairs of his city and state. He has served in the West Virginia Legislature and as a practicing attorney. He has been identified with many commercial interests, and was National Commander of the American Legion in 1922 and 1923.

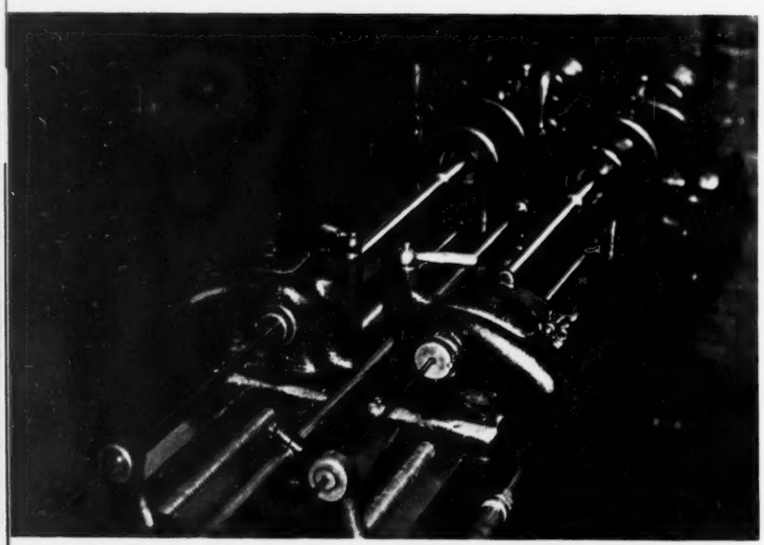
Manufacturing in



Milling the Profile of the Extractor Cam on the Bolt for a 0.30-caliber Rifle at the Springfield Arsenal



Employing a Circular Cutter for Milling an Internal Thread in the Receiver for a 0.30-caliber Rifle, the Work being Accurately Held in a Fixture



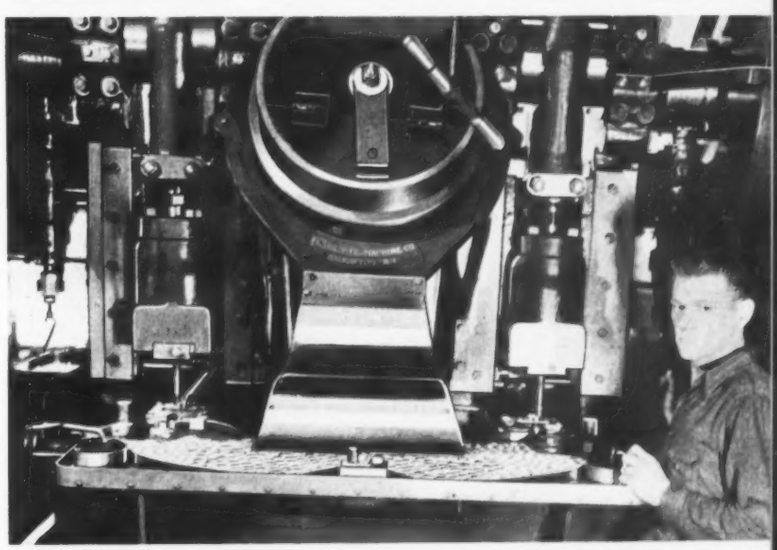
Rifle Barrels are Drilled Two at a Time in Standard Machines which Revolve the Work while the Long Drills are Fed Forward on Carriages

The Use of a Multiple-spindle Head Arranged for Indexing Facilitates the Reaming and Chamfering of Rifle Barrels at the Springfield Arsenal

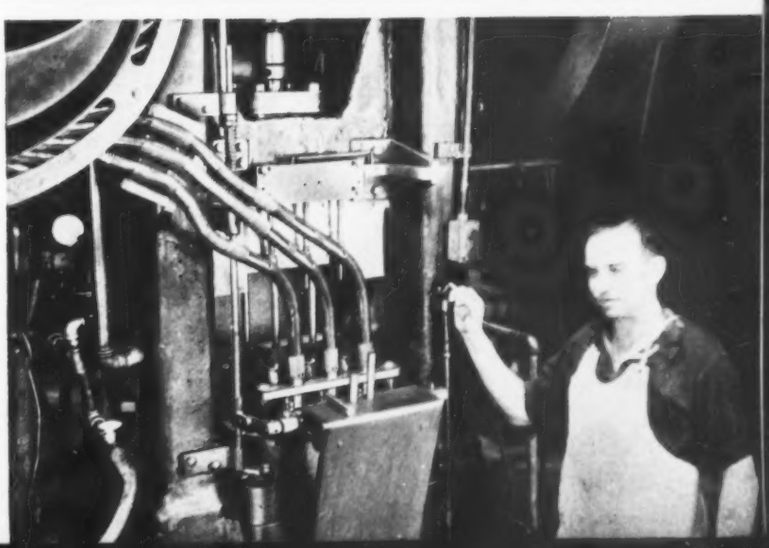
Army Arsenals

A Special Machine of Ingenious Design is Employed for Shaving a Cam at the Front and Rear of the Rifle Receivers

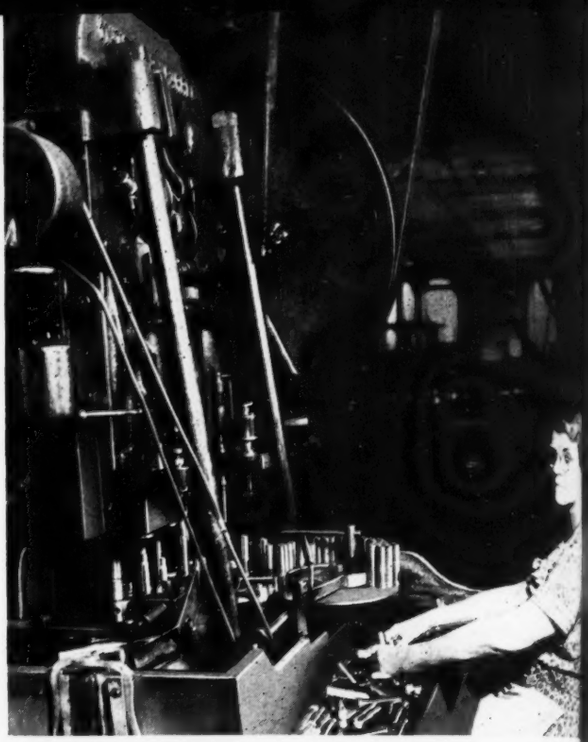
Blanking and Cupping 0.50-caliber Bullet Jackets Three at a Time at the Frankford Arsenal. A Cupping Punch Operates Inside of Each Blanking Punch



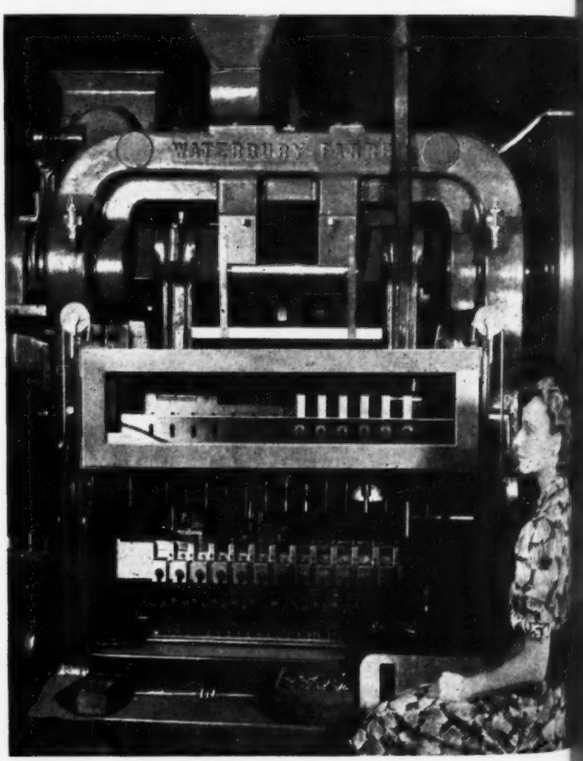
The Bullet Jackets are Fed Automatically from a Hopper for the First Drawing Operation, Performed in a Press with Rams at Both Sides



The Final Draw on the 0.50-caliber Bullet Jacket almost Doubles the Length, as Shown by the Pieces that are Seen Standing on the Guard

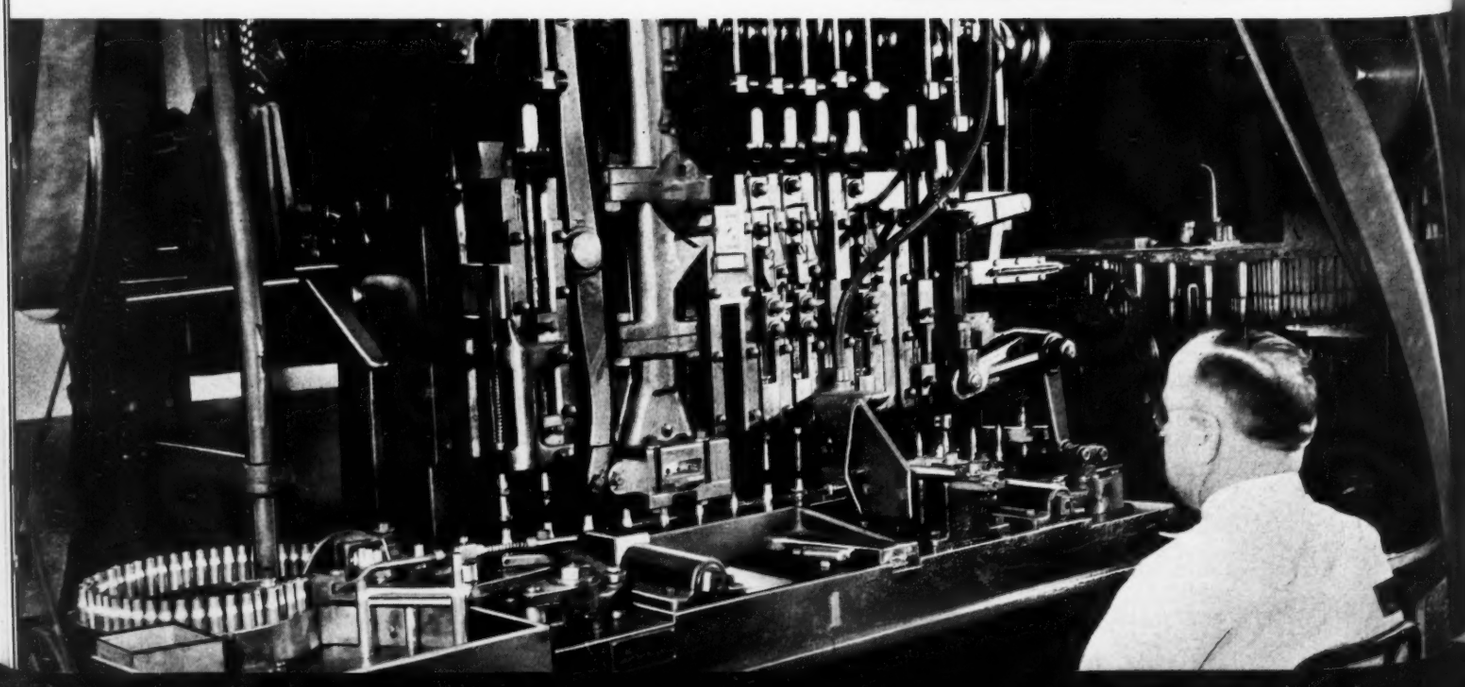


Tapering the Open Ends of 0.50-caliber Cartridge Cases under a Power Press Equipped with an Indexing Table that Positions the Work Pieces under Several Dies during Successive Strokes of the Press Ram



Bullet Jackets are Fed into This Machine at the Left, the Lead Slugs are Then Automatically Inserted, after which the Jackets are "Boat-Tailed" in a Series of Operations, the Bullets Finally Leaving the Machine at the Right-hand Side

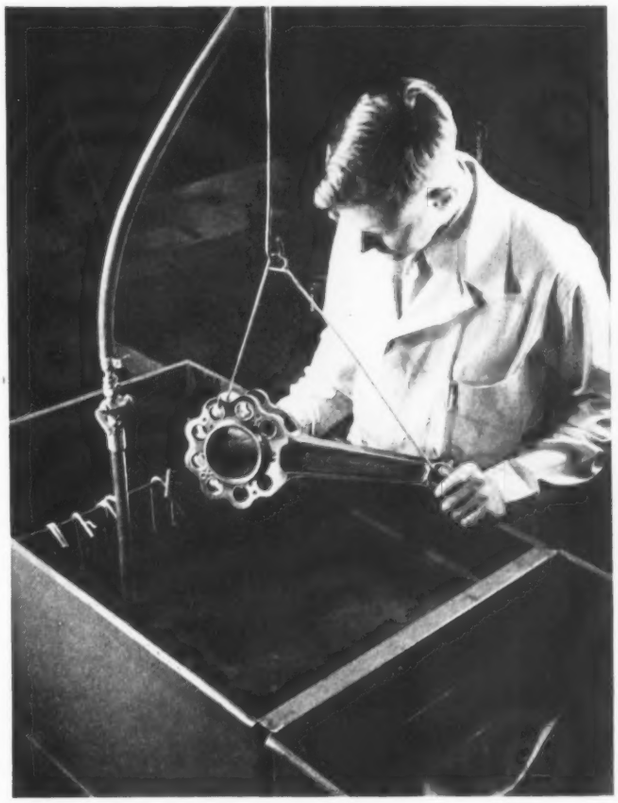
In Loading the 0.50-caliber Cartridge Cases at the Frankford Arsenal, the Cases are Fed down the Tube at the Left-hand End of the Machine Shown Below, Powder is Fed into Them through the Hopper near the Center of the Machine, and Bullets are Inserted from the Flexible Tube Seen Farther to the Right



Magnaflux Detects Hidden Flaws

An Inspection Method that Borders on Magic—It Brings Out Invisible Defects at or Near the Surface of Finished Iron and Steel Parts. Magnaflux Inspection is Now Widely Used for Parts on which the Safety of Human Life Depends

By CHARLES O. HERB



WITH the growth of aviation to the point where more than a million persons travel annually by this form of transportation in the United States alone, infallibility of airplane parts has become increasingly important. It is no longer sufficient to inspect parts merely for dimensions and visible surface defects. Means had to be developed for discovering flaws invisible to the naked eye that might grow and cause failure of a part in service. Because 100 per cent inspection of aircraft parts is necessary, any method of inspection for the purpose outlined had to be nondestructive and comparatively inexpensive.

These conditions were met by the development of Magnaflux inspection, a method that is licensed by the Magnaflux Corporation, Chicago, Ill. This inspection exposes fatigue cracks, grinding checks, seams developed by the rolling mill, and so on. Flaws as deep as 2 inches below the surface that would defy detection even under a 20-power microscope are made readily apparent to the human eye. Surface cracks 0.0002 inch deep can be detected.

In fact, this inspection process is so sensitive to irregularities in the structure of steel parts that there will be Magnaflux "indications" of so little consequence that they could have no appreciable influence on the strength of the part. An important factor, then, in the successful application of the Magnaflux process is intelligent judgment as to what constitute harmful defects in a part and what are merely marks that have no bearing on the capability of the part to render thousands of hours of satisfactory service.

Briefly, the Magnaflux principle as applied in the aircraft industry consists of magnetizing the parts to be inspected, so as to set up a polarity between any cracks or breaks either on the surface of the metal or below it for approximately 2 inches. The part is then immersed in an oil in which finely powdered black magnetic iron oxide is held in suspension or else it is sprayed or flooded with the oil. Particles of the iron oxide will adhere to the surface of the work wherever the polarity of a flaw attracts them, and these particles form a black line that is immediately observed by the inspector.

At the left in Fig. 2 is shown a gear that appears completely satisfactory, and yet when that gear was magnetized and placed in a Magnaflux bath, two serious cracks were exposed near the roots of the teeth, as shown in the right-hand view.

Magnaflux inspection has been universally adopted throughout the aircraft industry. Generally speaking, every steel part that goes into an airplane is checked by this means, whether the part is to be assembled into the engine, the propeller mechanism, or the plane itself. Some parts are checked several times during the manufacturing process, and also when completely finished, so as to insure that only flawless parts will reach the assembly benches.

Magnaflux is used also in the maintenance shops of the Air Lines. The heading illustration, for example, shows a master connecting-rod being inspected in the maintenance shop of Transcontinental Western Air, Inc., after being immersed in a tank containing the Magnaflux fluid. This connecting-rod was previously magnetized in the Magnaflux machine illustrated in Fig. 1. When the inspection has been completed, the part is demagnetized by placing it in a box-like electrical unit, such as seen in Fig. 4, which is also built by the Magnaflux Corporation.

Magnaflux Inspection Insures Reliability of Wright Aircraft Engines

Crankshafts, cylinder barrels, and every other stressed steel part that goes into the Whirlwind and Cyclone engines, manufactured by the Wright Aeronautical Corporation, Paterson, N. J., are carefully inspected by the Magnaflux method. Six Magnaflux machines are in constant use.

Fig. 3 shows the latest machine, which is used for magnetizing large parts, such as connecting-rods, crankshafts, and propeller shafts. The work is supported, as shown, in V-blocks attached to poles, by means of which direct current is passed through the part in such a manner as to create a magnetic field at right angles to possible defects. Electric current with an amperage up to 3000 is applied by this machine in magnetizing heavy sections, and as low as 400 amperes for pieces of small section. Parts up to 6 feet in length can be handled with this equipment.

With the part supported in the V-blocks of the poles, ready for magnetizing, the liquid containing particles of iron oxide is flooded over it by means of a hose. An instant before the hose is taken away, the current is passed through the part, magnetization taking place while the liquid is still running off. This prevents any of the Magnaflux "indications" from being washed away by the full force of the liquid stream. After careful inspection to detect any flaws made visible by the process, the parts that are found satisfactory are demagnetized by simply placing them within one of several units of the type shown in Fig. 4. Finally, the iron oxide and oil are washed off in a bath and the part is slushed with grease to prevent corrosion while in storage.

Cylinder barrels are magnetized in the machine shown in Fig. 6 for the purpose of detecting longitudinal defects. After being magnetized, the cylinder barrel is immersed in a tank of Magnaflux fluid, carefully inspected for flaws, and then remagnetized in the coil type fixture seen at the right for finding transverse defects. Immersion of a cylinder barrel in the Magnaflux bath is illustrated in Fig. 5. It is the practice to keep the liquid agitated in the various tanks by forcing air through it. This keeps the magnetic iron particles completely in suspension.

Small parts, such as cylinder hold-down studs, are magnetized at the Wright plant by an operator holding a quantity of them at a time between the

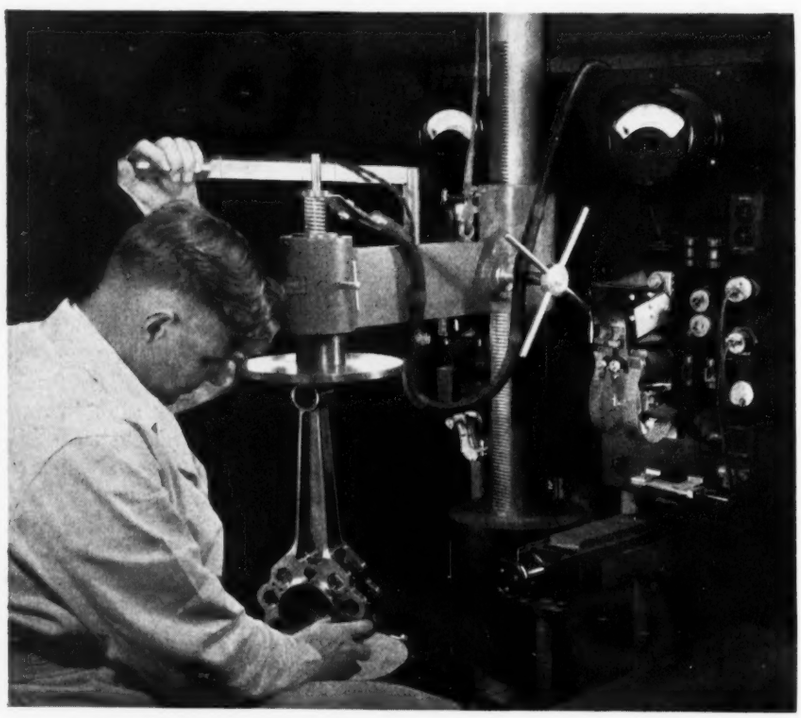


Fig. 1. Magnetizing an Airplane Master Connecting-rod Preliminary to Inspecting it by the Magnaflux Process, as Shown in the Heading Illustration

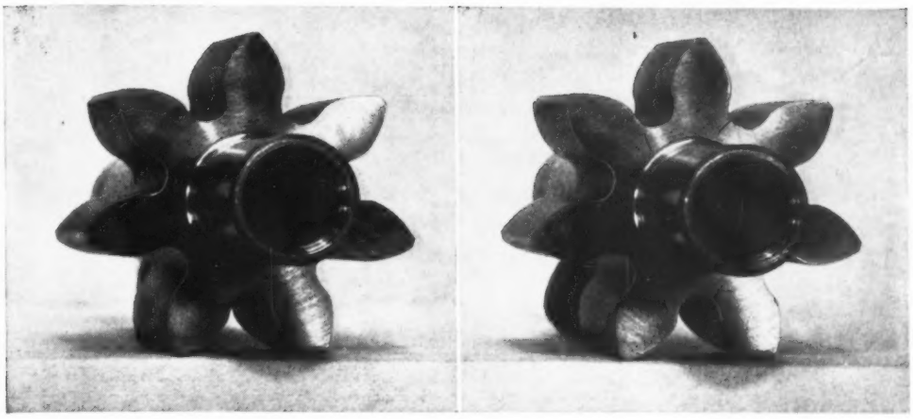


Fig. 2. The Apparently Satisfactory Gear at the Left was Found by the Magnaflux Inspection Process to have Two Serious Cracks, as Seen in View at Right

poles of a vertical type machine, such as illustrated in Fig. 6. A number of these small parts are then placed on a tray and submerged in the Magnaflux bath at one time.

Applications of Magnaflux Inspection in Other Industries

Magnaflux inspection, however, is by no means confined to aircraft manufacturing and maintenance shops. It has been adopted by the automobile industry for checking such parts as crankshafts, axle shafts, steering knuckles, valve springs, and gears. In general, a percentage of parts is inspected.

An especially interesting application of the process at the plant of the Chevrolet Motor Co. in Flint, Mich., insures the use of dependable diaphragm clutch springs in the automobiles made by that concern. The Magnaflux inspection follows an operation in which these disk-like springs are flexed a number of times in order to develop any potential cracks. The cracks are detected by immersing the springs in the Magnaflux bath after they have first been magnetized in a simple electrical fixture.

The springs are placed on racks, as shown in Fig. 7, for immersing in the Magnaflux bath. The metal powder that clings to the spring surfaces when they are lifted from the bath makes even the most minute cracks readily apparent. An air hoist facilitates handling the racks in this operation. After the inspection, the metallic powder is completely removed by rolling the springs down the chute of the demagnetizing device shown in Fig. 8.

In the maintenance shop of the Surface Transportation Corporation, New York City, which operates several hundred buses, Magnaflux inspection has been adopted as part of the regular routine in overhauling engines, clutches, transmissions, spring shackles, etc. This insures that old parts put back into buses will be just as good as new parts. About

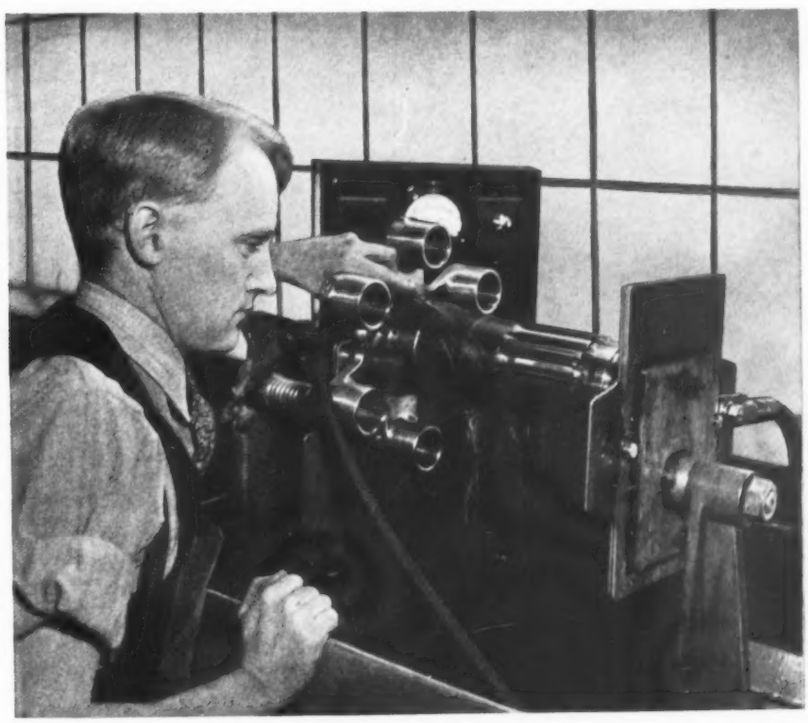


Fig. 3. One of the Magnaflux Machines at the Wright Aeronautical Corporation's Plant, which has a Capacity for Parts up to 6 Feet in Length

Fig. 4. One of the Demagnetizing Units in which the Inspected Parts are Placed to Remove the Fine Particles of Iron Oxide

Fig. 5. Inspecting a Cylinder Barrel in the Magnaflux Bath for Flaws that could not Ordinarily be Found with a High-power Microscope

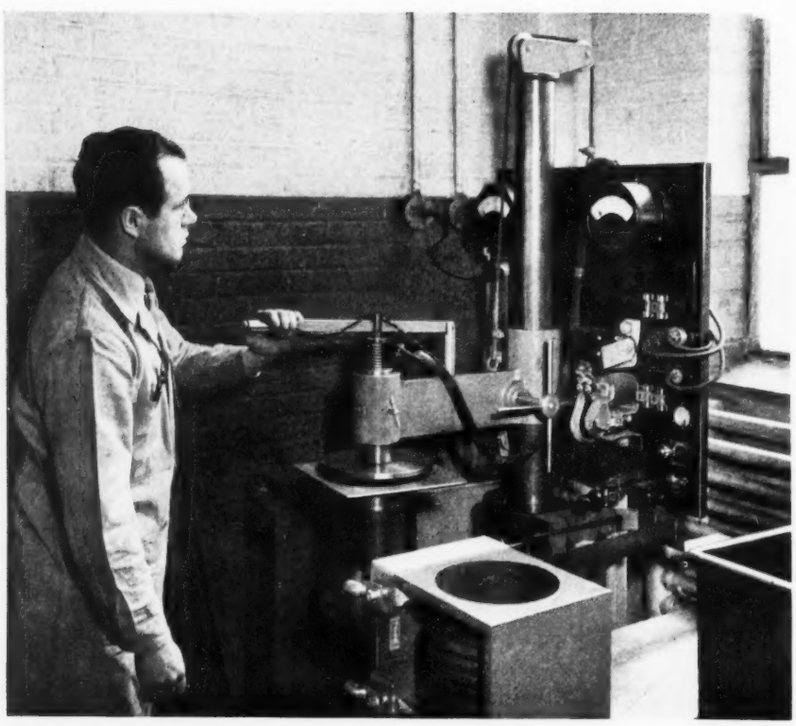


Fig. 6. Equipment Used by the Wright Aeronautical Corporation for Magnetizing Airplane Cylinder Barrels to Detect Longitudinal and Transverse Flaws

Fig. 7. After being Magnetized, Chevrolet Clutch Springs are Dipped into a Magnaflux Bath, which Makes Minute Cracks Apparent to the Naked Eye

Fig. 8. Clutch Springs are Rolled through This Simple Electrical Fixture to Demagnetize them and Free the Powder of the Magnaflux Bath

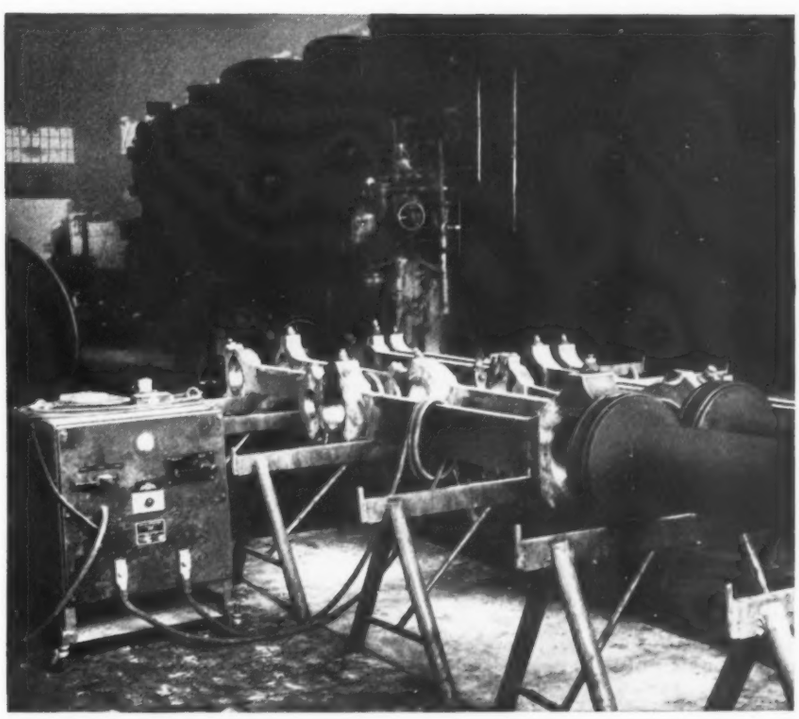


Fig. 9. Portable Magnaflux Equipment being Employed for Inspection of Side-rods in a Locomotive Repair Shop of the Denver & Rio Grande Railroad

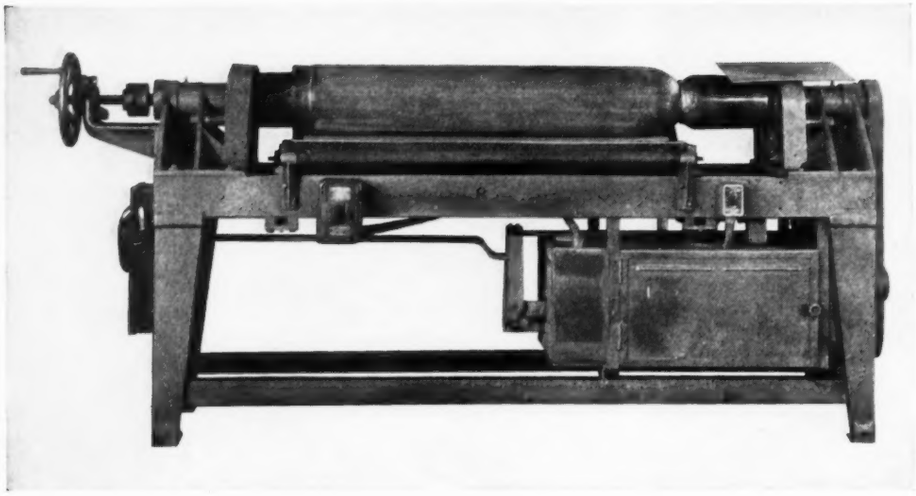


Fig. 10. Machine Used for Magnaflux Inspection of Gas Cylinders. Magnaflux Powder is Brushed on the Cylinders Automatically

15 per cent of the parts inspected are rejected, because they might cause serious accidents. It is interesting to note that of the thousands of parts that have passed the Magnaflux inspection, not one has ever broken in service.

Large Parts can be Inspected by a Dry Magnaflux Method

Large parts that cannot be conveniently immersed in a Magnaflux bath can be inspected by a dry method, which consists of magnetizing the part and then sprinkling white powdered iron oxide over its surface. This practice is followed in locomotive plants for detecting flaws in side-rods, eccentric cranks, cross-heads, draw-bars, axles, levers, links, springs, and other parts.

The use of a portable outfit for inspecting side-rods in one of the shops of the Denver & Rio Grande Western Railroad is illustrated in Fig. 9. This equipment is operated by alternating current, and is capable of delivering a maximum of 3000 amperes at 20 volts. Parts up to about 10 inches in diameter are inspected by wrapping four or five turns of cable around them and then applying the maximum voltage. The dry white Magnaflux powder is then sprinkled on the part. This equipment is also used for inspecting parts without dismantling them from the locomotives.

One of the shops of this railroad has a large stationary magnetizing machine for handling axles. With these outfits, thousands of locomotive parts have been inspected and many defects revealed that would not otherwise have been found.

At the plant of the Sun Shipbuilding and Dry Dock Co., Chester, Pa., the dry method is used for inspecting various types of welded vessels, such as high-pressure air storage tanks used in starting Diesel engines. These tanks are generally fabricated from plate 1 1/4 inches thick. A magnetic field is set up all through the tank by wrapping a large cable around it and charging it with direct current of low voltage. Magnaflux powder is then sprinkled over the welded seams, and any cracks or other defects are immediately indicated.

The same method is used at this shipyard to discover microscopic cracks in the corrosion-resistant lining provided on the inside of some types of pressure vessels. It is used in other instances where it is not necessary or convenient to apply the X-ray method of detecting flaws.

The dry Magnaflux method is being used extensively for determining the trustworthiness of the cylinders used for storing and transporting compressed and liquid gases. The inspection can be accomplished without removing the paint from the cylinder surfaces, thus enabling rapid and frequent inspection at low cost.

One of these cylinders is seen in the Magnaflux machine in Fig. 10. The cylinder is magnetized by this equipment and revolved in contact with a wood roller, covered with cloth having a heavy nap. This roller revolves in a trough filled with Magnaflux powder and brushes it around the cylinder. Defects in the cylinder walls, such as laps, seams, closed-in draw marks, and slag inclusions, are indicated by collections of the white powder. A closed-in draw mark that extended practically the full length of the cylinder seen in the illustration, was disclosed by the Magnaflux inspection. One pound of powder is sufficient for the inspection of from 100 to 150 cylinders.

Magnaflux inspection is applicable to the entire iron and steel group, but not to austenitic steels, such as the 18 and 8 stainless type. Parts can be inspected without injury to their finish, even though they have been polished, plated, lacquered, or painted.

* * *

Specifications for Overhead Track Systems

The Monorail Manufacturers Association, 165 Broadway, New York, approved on October 1 a set of specifications for overhead track systems, copies of which can be obtained from the Association. These specifications cover many items relating both to construction and installation. Included in the data are standard specifications for wire rope electric hoists.

Has a Patentee the Right to Threaten Suit for Infringement?

A Review of Legal Decisions Answering the Question whether the Owner of a Patent may be Held Liable for Damages if Threatening to File Suit Against an Alleged Infringer

By LEO T. PARKER, Attorney-at-Law
Cincinnati, Ohio

CAN the owner or licensee of a patent be held liable in damages for threatening to file suit against an infringer, if the threat results in financial loss to the alleged infringer? This is a question of interest to every owner of a patent.

First, it is important to note that a patentee can without liability send notices of infringement and threats of suit, if such threats are made in good faith and the patentee sincerely believes that his claims are valid. This is true even if such threats result in financial loss to those who receive the threats. For example, in Alliance Securities Co. v. De Vilbiss Mfg. Co. [41F (2d) 668], the Federal Court said:

"We are aware of no ground upon which claims of infringement made by a patentee can be considered a legal wrong, unless those claims are made in bad faith; that is, maliciously. This bad faith may be made to appear in a variety of ways, but until it does appear, the patentee has the right to notify all those whom he believes to be infringing that he will hold them for such liability as he may be able to establish; indeed, it has been said that it is his duty to do so, and it is apparent that under some circumstances he may lose rights if he does not do so."

Also, in H. W. Johnson Co. [189 F. 611, 613], it was shown that a patentee sent notifications to various firms in which it was stated that suit would be filed for infringement of his patent unless the infringing acts ceased at once. Certain persons who received these notifications, and others whose business of selling was being injured by customers receiving these notices, filed suit against the patentee and asked the Court to grant an injunction to prohibit the patentee from sending such notifications. However, the Higher Court refused to grant the injunction, saying:

"It is clear that . . . it would be unjust to prevent him [the patentee] from advising users of his rights, etc. Of course, this view is not inconsistent with the right of a Court in which an infringement suit is pending to restrain the plaintiff [patentee] from oppressive and inequitable harassing of the defendant's customers. Occasional instances are to be found of late years where injunctions have been issued against claims of infringement, and where the necessity of this basis in bad faith has not been expressly regarded as essential, but we find no such case which cannot be explained consistently with this fundamental basis and which is authoritative or sufficiently persuasive."

Also, in Featherbone Co. v. Landauer [151 F. 130], the Court refused to issue an injunction against a patentee, where it did not appear that he was acting in bad faith, and where the testimony showed that the statements made by the patentee in the circulars were true, to the effect that a suit for infringement was pending.

A Case where Court Orders Patentee to Correct Circular

If a patentee *unintentionally* distributes incorrect circulars, warning that suit will be filed for infringement of his patent, the Court may order him to amend or correct the statements. In the case of Bonnie B. Co. v. Giguet [269 F. 272], it was disclosed that a patentee filed an infringement suit and then proceeded to notify the trade of the alleged infringement. The alleged infringer filed suit against the patentee and asked the Higher Court to grant an injunction and prohibit him from distributing the circulars that contained incorrect statements regarding the suit.

It is important to note that the Court denied the injunction, but ordered that the circular be amended and corrected to set forth merely the claim of the patent, declaring that under the circumstances the circularization was within the patentee's rights.

Again, in Pentlarge v. Pentlarge [Fed. Cas. No. 10, 965a], the Court held that a patentee cannot be prevented from bringing suits upon his patent, notifying others of its validity, and threatening all with suits who infringe it. The Court explained that the right to bring suits for infringements includes the right to threaten infringers with suit.

When Owner of a Patent Holds an Invalid Patent

In another case [Virtue, 142 N.W. 930], it was shown that a patentee, not knowing that he held an invalid patent, notified many firms that he intended to sue everyone for damages who infringed his patent. The Court held that the patentee was not liable, even though his patent proved to be invalid. The Court explained that if he had calculated to injure another's business, his conduct was malicious; otherwise he was not liable.

In fact, under any circumstances, a person who intentionally sends malicious, damaging, and incorrect notices to customers of competitors is liable in damages. For example, in a leading case [Smith, 194 Pac. 502], the Court held a manufacturer liable for sending notices to the customers of a rival manufacturer, in which it was *falsely* stated that certain goods manufactured by the rival were an infringement on his patent, and that if they continued to handle the goods, suit would be filed for an injunction and for damages. In this case, the customers discontinued buying the goods, because they were afraid that the patentee would sue them. Under these circumstances, the patentee is liable for financial losses suffered by the rival or competitor.

On the other hand, in order that anyone can recover damages from a patentee who sends out threats of suit for infringement, it is necessary that the one who sues shall prove that the warnings of patent infringement and threats of suit are made in bad faith. If the notifications are promptly followed by a suit for infringement, the one who sues the patentee is not entitled to a recovery. In the leading case of Pack, 179 F. 115, the Court said: "That the owner of a patent may notify infringer of his claims, and warn them that, unless they desist, suits will be brought to protect him in his legal rights, is sustained by numerous decisions ... The only limitation on the right to issue such warnings is the requirement of good faith."

Misrepresentations May Invalidate Patent Rights

In Panay v. Aridor Co. [292 F. 858], the Federal Court explained that courts will protect patentees who have established a business, but that a patentee who, in order to scare or daunt competitors, issues threats of suit for alleged infringement, and in advance of adjudication, comes into court with unclean hands, may on that ground be denied the relief in a suit for infringement to which he might otherwise be entitled.

In other words, if a patentee actually files a suit for infringement after practicing unfair methods on the one he sues, the Court will hold that the patentee is not entitled to relief. In Art Works v. Abraham [70 F. (2d) 641], the Court denied the patentee in a patent infringement suit any relief, because of his misrepresentations to the trade, including the customers of the one he sued, as to the true facts of the controversy.

In Sewin v. Welsbach Light Co. [81 F. 904], the Court granted an injunction against false statements about a patent infringement made in advance of the Court's decision. In Nation Co. [98 F. 118], the Court said that threats of a patent infringement suit could be prevented when they were made falsely, fraudulently, maliciously, and with intent to destroy a competitor's business.

Summary of Patentee's Rights

The present law is well stated in Court in Aronson v. Orloo [116 N.E. 951]. In this case, the Court said: "The owner of a patent already issued may notify infringers and warn of his intents to protect his rights, if he acts in good faith ... But even an owner of a patent cannot attack a rival in business in bad faith, and by threatening letters seek to intimidate his customers and coerce that rival to yield to unjustifiable demands ..."

In Tool Works v. Costa [9 F. Supp. 440], the Court said: "He [the patentee] has demonstrated that he honestly believes his patent to be valid and infringed, and he therefore has the right to protect his claims from further invasion by notifying the trade of an alleged infringement through notices which contain no false, offensive, or opprobrious language."

On the other hand, as previously explained, if the testimony indicates that the patentee sent out notices in bad faith and with the intention to intimidate, rather than to correctly inform, the infringer's customers, then the patentee is liable for damages.

* * *

Automobile Exports Reach High Level

One out of every five American motor vehicles produced in 1938 was sold in markets outside of the United States. Approximately 475,000 cars and trucks were sold abroad during the year. This is about 22 per cent of the production, as compared with 13 per cent in 1937. While the number of units is below the number sold abroad in 1937, it is slightly above the five-year average for the period 1933-1937.

The automobile industry is the leading exporter among the manufacturing industries of the United States. It is estimated that 50,000 wage-earners, receiving some $86,000,000 in wages annually, are employed in the automobile factories in producing these cars for the export trade. In addition, of course, there are tens of thousands of men engaged in making the materials that go into the manufacture of these exported cars and trucks. Could one accurately estimate the number of people so employed, it is likely that one would find that 150,000 American workers depend for their livelihood on the exports of automobiles. Since, generally speaking, these exports are paid for by imports of other goods, imports, too, are necessary to keep these workers employed.

Cartridge Cases for the Navy's Guns

Some of the Operations Employed in Producing Cartridge Cases for the Navy's Guns at the United States Navy Yard in Washington, D. C.

By CHARLES O. HERB

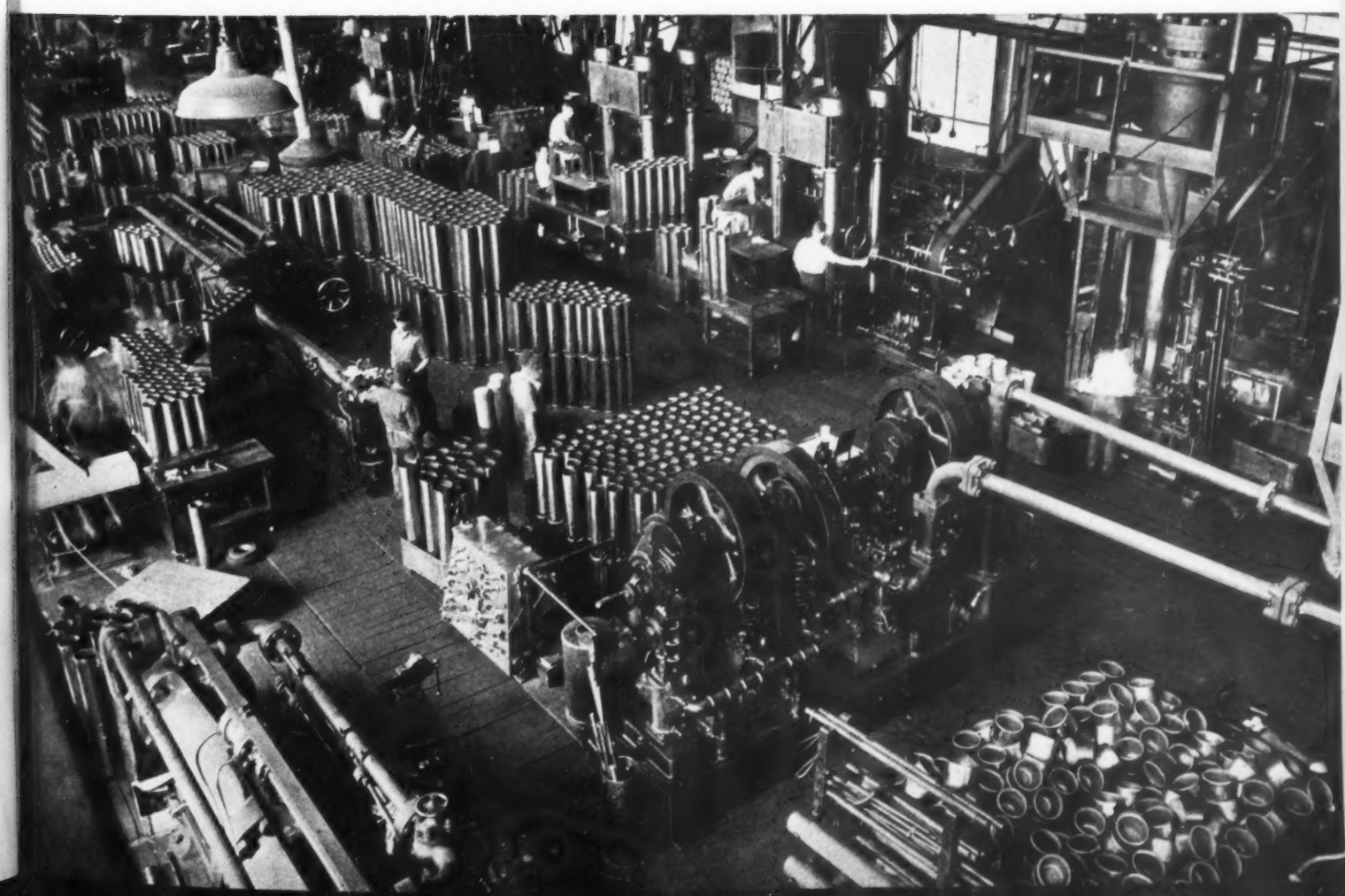
EXPLOSIVES for firing the big guns of the United States Navy are loaded into the powder chamber in bags after the heavy projectile has been inserted in the gun bore. With guns up to about 6 inches caliber, however, the explosive is contained in a brass cartridge case. The projectile is attached to cartridge cases of the smaller calibers, but is separate from the larger cartridge cases.

Cartridge cases of all sizes are made in the United States Navy Yard, Washington, D. C., by truly high-production methods, as will be apparent from the illustration below, which shows a general view in the cartridge case plant. Slabs of brass cast in the foundry of the Yard are rolled to the required thickness in the cartridge case plant and are then blanked into disks of predetermined diameter. The blanking operation is performed in hydraulic presses.

Successive Drawing Operations in Producing Cartridge Cases

These disks are next "cupped" in an operation such as illustrated in Fig. 1, which is also performed under a hydraulic press. This illustration shows a brass disk lying in the die directly beneath the heavy punch. The disk is approximately 12 inches in diameter by 1/2 inch thick, and is drawn in one step to a depth of 6 inches, as shown by the sample at the right of the punch and also by the sample at the extreme left in Fig. 2. Each cup is pushed through the die and rolls to a pit at the rear of the press.

Following the cupping operation, the now partly formed cartridge case is subjected to a succession of drawing operations performed in horizontal presses, which are also hydraulically actuated. One of these operations is illustrated in Fig. 4. In each



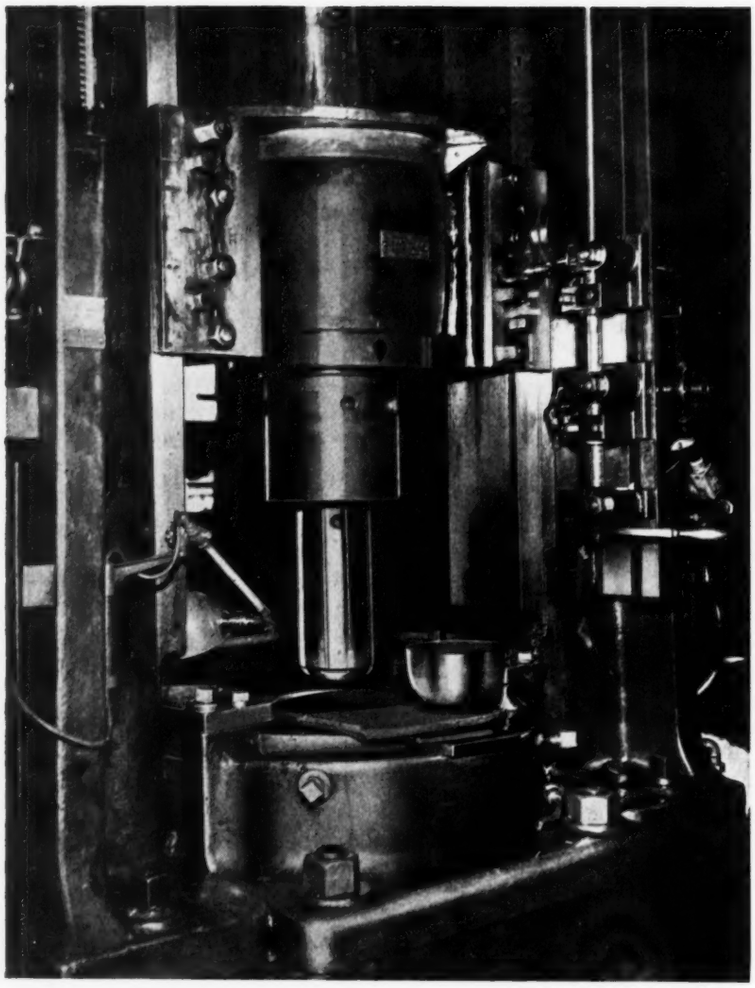


Fig. 1. Cartridge Cases Consist of Long Shells Drawn in Successive Operations from Brass Disks. Here the Disks are Shown being Formed into Cups by a Hydraulic Press

operation, the cartridge case is slipped over a long punch and is pushed through a die of smaller diameter than the case. The operation thus decreases the diameter and wall thickness of the cartridge case and effects a considerable increase in its length.

In the particular operation shown in Fig. 4, the seventh draw on the cartridge case is performed. This causes a 76 per cent increase in the length of the case, as may be seen from the two samples on the box at the left of the machine. When the cartridge case comes to this machine, it has a length of 17 inches and when it leaves, the length has been increased to approximately 30 inches. Fig. 2 indicates by cross-sectional views the sequence and number of operations performed in producing a typical cartridge case.

After the Drawing Operations, the Closed End is Headed in a Hydraulic Press

When the cartridge cases have been drawn to their full length, the closed end is headed in the dies of a hydraulic press of the type illustrated in Fig. 3, which presses the closed end to the desired shape. Some cartridge cases are subsequently tapered at the open end to a diameter somewhat smaller than the body of the case, as

Fig. 2. Disk from which a Typical Cartridge Case is Drawn and Cross-sectional Views which Indicate the Sequence and Number of Operations Required for its Production

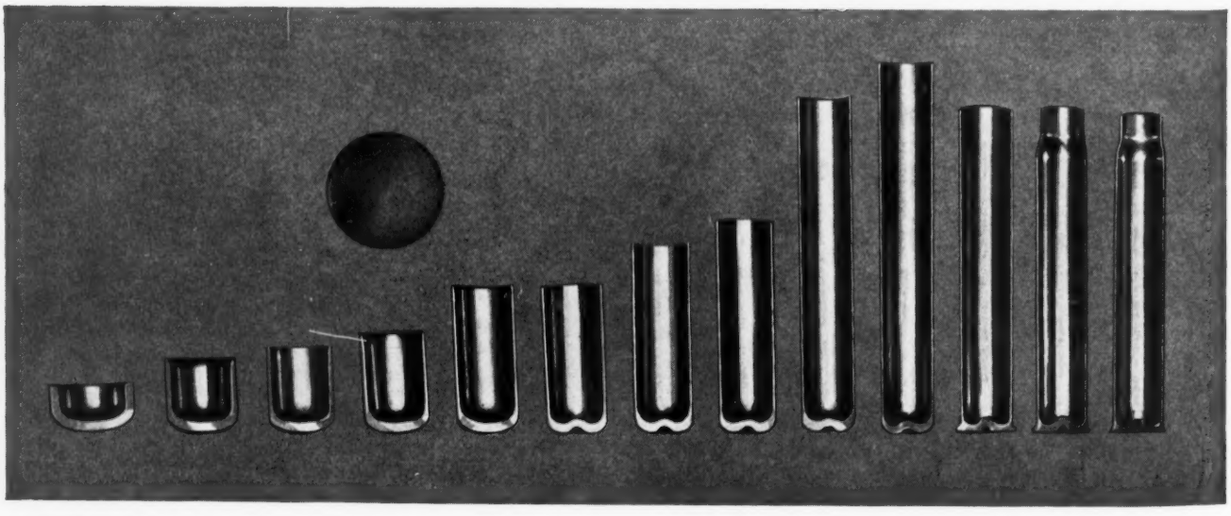


Fig. 3. The Closed End of Cartridge Cases is Headed to the Required Shape by Means of a Pressing Operation Performed under a Hydraulic Press

seen at the extreme right in Fig. 2, whereas others are left straight. The tapering operation is performed in a large hydraulic press which presses the mouth of the case into a series of tapered dies.

* * *

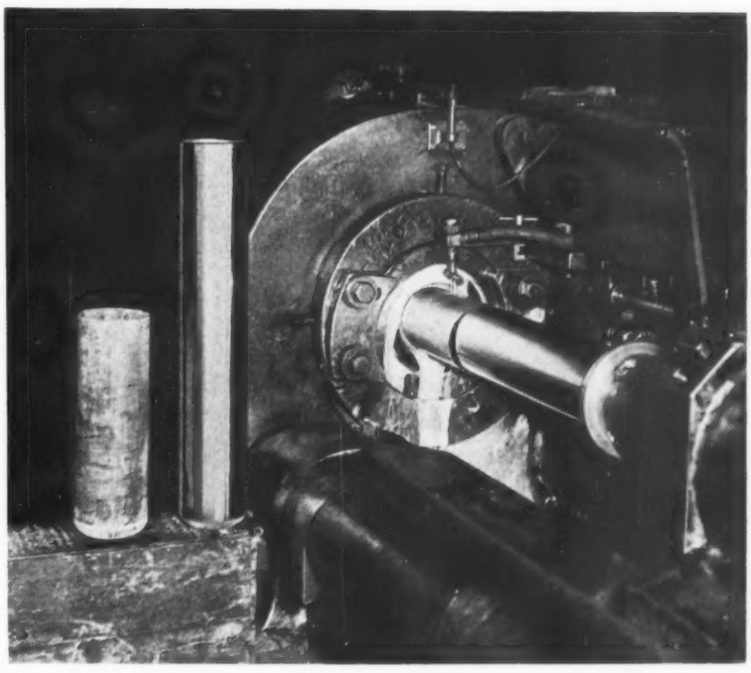
Aircraft Industry in 1937

Complete statistics covering the aircraft industry in the United States in 1937 have now been published by the Bureau of the Census, Washington, D. C. According to the figures made available, there were 92 establishments engaged in the manufacture of aircraft and aircraft parts. The average number of wage-earners employed was 24,000, and the total value of the products of the aircraft plants was $106,570,000. These figures, however, do not give a complete picture of the aircraft industry. Manufacturers reporting were instructed to include in the value of the aircraft, the value of instruments and accessories, but not the power plant (engine, propellers, etc.). Were the engines included, the total figure would be very much higher. Separate statistics will be available later covering engines and propellers.

* * *

Industrial diamonds form an important item among the materials used in connection with the production of automobiles. The General Motors Corporation, for example, during the course of a year, is said to buy more than $250,000 worth of industrial diamonds.

Fig. 4. The Seventh Drawing Operation in the Production of a Cartridge Case. In this Operation the Length is Increased Approximately 76 Per Cent, while the Diameter and Wall Thickness are Correspondingly Decreased



Copper-Brazing Turbo Coil Supports

By L. D. JENNINGS
Generator Works Department
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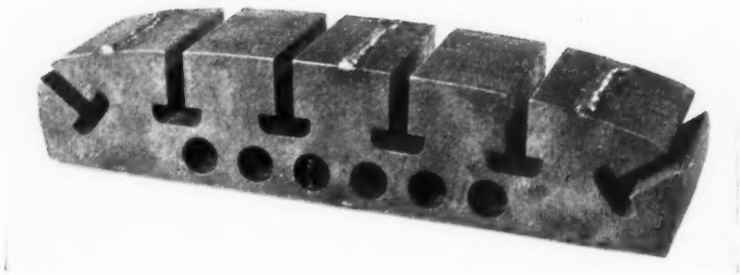


Fig. 1. The Punchings for the Coil Supports are Welded across the Edges of the Laminations to Hold Them Rigidly while being Brazed

THE centrifugal and electrical forces that tend to pull the coils from the poles of rotating electrical apparatus are overcome at the pole ends by providing coil supports. The pole is usually fabricated by stacking punched laminations to form the body, adding a coil support at each end, and holding the assembly together with bolts or rivets. The coil supports are cast or fabricated of aluminum, bronze, or steel, depending upon the design of the pole, the shape of the damper bar, the strength required, and the electrical characteristics of the machine.

The electrical demands of many of the present-day synchronous motors, condensers, and water-wheel and turbo generators make it advisable to employ a T-shaped damper bar fabricated from unlike copper alloys rather than the round or rectangular bar found in the average machine in the past. Also, many of the larger machines demand a steel support with a non-magnetic section adjacent to the body of the pole.

These two requirements, a T-shaped slot and a non-magnetic section, have complicated the fabricating problem; should a casting or a solid section be employed, special and expensive tooling would be required to machine the T-slots and the non-magnetic section accurately. This difficult fabrication problem has, however, been successfully and economically solved by copper-brazing a number of steel laminations together to obtain a solid coil support.

The copper-brazed supports are fabricated as follows: Non-magnetic and low-carbon steel punchings are assembled as received from the punch press on a locating fixture, and welded across the edges of the laminations, as shown in Fig. 1, to hold the punchings rigidly while they are brazed. The

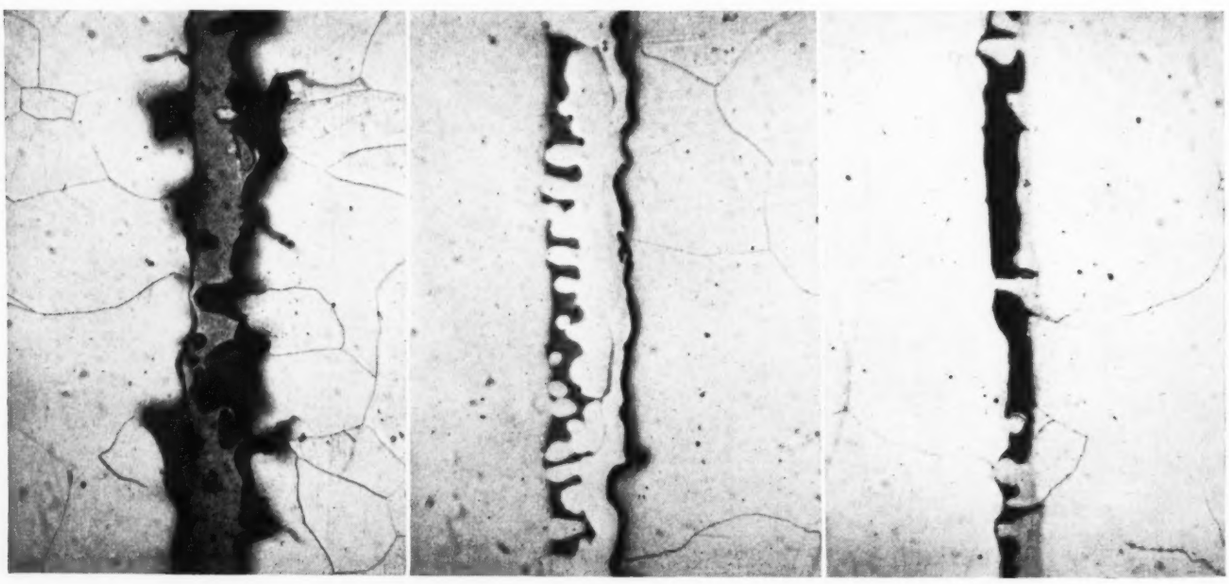


Fig. 2. (Left) Photomicrograph Showing the Bond between Two Carbon-steel Sheets. Fig. 3. (Center) Photomicrograph Showing the Bond between a Carbon-steel and a Non-magnetic Stainless-steel Sheet. Fig. 4. (Right) Photomicrograph Showing the Bond between Two Non-magnetic Stainless-steel Sheets

assembled punchings are then stacked in a bell type annealing furnace, with copper saw cuttings in the circular holes and fire-clay packed in the T-slots to prevent the excess copper from filling the slots. The furnace temperature is raised to from 1175 to 1195 degrees C. as quickly as possible, held at this point for four hours, and then reduced to 300 degrees C. before the furnace is opened. The brazing is done in an atmosphere of pure dry hydrogen, and this atmosphere must protect the charge as soon as the furnace temperature reaches 500 degrees C. to prevent oxidation of the non-magnetic steel.

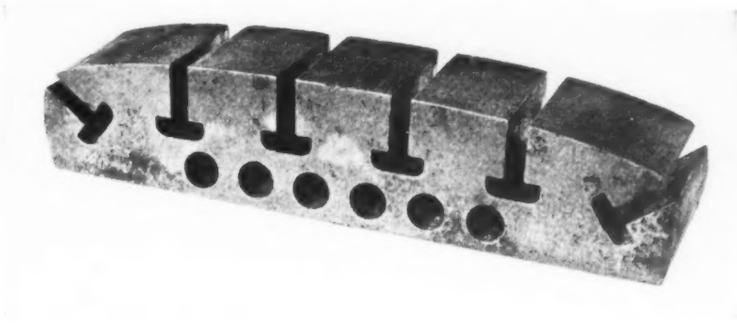


Fig. 5. The Coil Support after being Removed from the Furnace, Showing the Brazed Laminations Firmly Bonded with Copper

When removed from the furnace, the laminations are firmly bonded with copper and the slots are relatively free of excess material (see Fig. 5). The weld metal is removed by grinding, the holes drilled, and the T-slots broached to finished size, after which the coil support is ready to assemble on the field pole.

The copper bond between the laminated sheets is shown by photomicrographs of a section of the brazed support in Figs. 2, 3, and 4.

Fig. 2 is typical of the bond between low-carbon steel sheets. The medium gray constituent at the center of the photograph is copper, while the dark material is the region in which the copper has alloyed with the steel. Fig. 3 represents a bond between low-carbon steel and stainless-steel sheets. The material at the left of the dark line is carbon steel, while the material at the right is stainless steel. The gray constituent between the sheets is copper. Fig. 4 shows the bond between two stainless-steel sheets. The severe etching required for the stainless steel has completely removed the copper between the laminations, as indicated by the black line at the center.

The copper-brazed coil support fabricated with steel punchings solves the difficult problem of obtaining a solid inexpensive support containing a non-magnetic section and the desired T-slots.

Heavy and High-Speed Shallow Cuts Compared

By M. JACKER

SOME lathe operators believe they can produce faster by taking several shallow cuts at high speed instead of one heavy roughing cut at a slower speed and a shallow finishing cut at high speed. The fallacy of this belief can be shown by MACHINERY'S Data Sheet No. 368 for April, 1938. The third, eighth, and eleventh lines of this table, which pertains to machining nickel and nickel alloys, supply the data for finding the cutting time indicated in the right-hand column of the accompanying table.

The high-speed shallow cut would require two cuts, each of which is a little less than 1/8 inch deep, and one finishing cut of a few thousandths inch instead of one heavy cut a trifle under 1/4 inch deep at a slower speed, followed by a light finishing cut at high speed. For the two 1/8-inch cuts, reference is made to the figures in the eighth line of the table. Thus $2 \times 0.882 = 1.764$, which is the cutting time required in seconds per foot. For convenience, the finishing cut time of 0.508 second per foot is taken from the third line in the table. Thus the total time for the two 1/8-inch cuts and a finishing cut is 2.272 seconds per foot.

The deep cut method, requiring a cut almost 1/4 inch deep and a fine finishing cut, is accomplished at the rate of one foot in 1.053 seconds. Taking 0.508 second per foot from the third line for the finishing cut, the total for the heavy cut method is 1.561 seconds per foot. The difference in time between the two different turning methods equals 2.272 — 1.561 or 0.711 second per foot. Therefore, 0.711 second per foot more time is required for the high-speed shallow cut method. On turning 1/2 inch from the diameter of a piece of work 3.83 inches in diameter by 6 inches long, the difference in time is 1.983 minutes. This saving of nearly two minutes per piece with the heavy cut method is an important item on work only 6 inches long.

Data Used in Comparing Results Obtained in Taking Heavy and Shallow Cuts

Location of Data in Table	Information from MACHINERY's Data Sheet No. 368 for April, 1938			Cutting Time, in Seconds per Foot
	Depth of Cut, Inch	Feed, Inch per Revolution	Wrought Monel Nickel, Speed in Feet Per Minute	
3rd Line	1/32	1/32	118	0.508
8th Line	1/8	1/32	68	0.882
11th Line	1/4	1/32	57	1.053

The Chordal Gaging of Spur Gear Teeth

By ROBERT PARKES, Designer
Western Machine Tool Works, Holland, Mich.

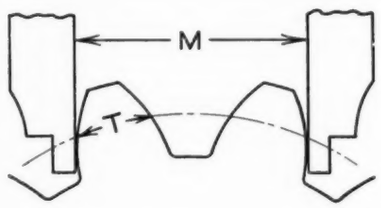
THE gaging of spur gears by measuring the chordal distance across a preselected number of teeth is a simple method which may be applied to all spur gear tooth forms. The accompanying tables greatly simplify its application by enabling anyone to determine easily and quickly the accurate chordal dimension for a given number of teeth, diametral pitch, and pressure angle. These tables include pressure angles of both 14 1/2 and 20 degrees and a wide range of tooth numbers. In the shops with which the writer is connected, this chordal method of gaging spur gears is much preferred to other methods because of its speed and accuracy. It has given consistently reliable results in the production of accurate gears, with the amount of backlash controlled to suit the requirements of each particular installation. The only investment in gaging equipment required is an accurate vernier caliper.

Table 1 gives the chordal dimensions for 1 diametral pitch when measuring over the number of teeth indicated in Table 2. The chordal distance across the pitch points is a geometrically correct value for the number of teeth indicated.

To obtain any chordal dimension, it is simply necessary to divide chord *M* in the table (opposite the given number of teeth) by the diametral pitch of the gear to be measured and then subtract from the quotient one-half the total backlash between the mating pair of gears. In cases where a small pinion is used with a large gear and all of the backlash is to be obtained by reducing the gear teeth, the total amount of backlash is subtracted from the chordal dimension of the gear and nothing from the chordal dimension of the pinion. The application of the tables will be illustrated by an example.

Example—Determine the chordal dimension for checking the size of a gear having 30 teeth of 5

Table 1. Chordal Measurements over Spur Gear Teeth of 1 Diametral Pitch



Find value of *M* under pressure angle and opposite number of teeth; divide *M* by diametral pitch of gear to be measured and then subtract one-half total backlash to obtain a measurement *M* equivalent to given pitch and backlash. The number of teeth to gage or measure over is shown by Table 2.

Number of Gear Teeth	M In Inches for 1 D.P.	Number of Gear Teeth	M In Inches for 1 D.P.	Number of Gear Teeth	M In Inches for 1 D.P.	Number of Gear Teeth	M In Inches for 1 D.P.
Pressure Angle, 14 1/2 Degrees							
12	4.627	34	7.784	56	13.986	78	20.189
13	4.632	35	7.792	57	13.992	79	20.194
14	4.637	36	7.797	58	13.998	80	20.200
15	4.643	37	7.803	59	14.002	81	20.204
16	4.648	38	10.849	60	14.008	82	20.208
17	4.652	39	10.855	61	14.012	83	20.214
18	4.660	40	10.858	62	14.020	84	20.221
19	7.706	41	10.864	63	17.067	85	20.226
20	7.711	42	10.870	64	17.072	86	20.230
21	7.717	43	10.876	65	17.078	87	20.236
22	7.722	44	10.882	66	17.084	88	23.284
23	7.727	45	10.886	67	17.087	89	23.289
24	7.733	46	10.892	68	17.094	90	23.292
25	7.738	47	10.896	69	17.098	91	23.300
26	7.744	48	10.903	70	17.104	92	23.306
27	7.749	49	10.909	71	17.112	93	23.311
28	7.752	50	10.914	72	17.114	94	23.316
29	7.758	51	13.958	73	17.118	95	23.322
30	7.764	52	13.964	74	17.126	96	23.327
31	7.770	53	13.970	75	17.131	97	23.332
32	7.775	54	13.976	76	20.176	98	23.338
33	7.781	55	13.982	77	20.183	99	23.343
100	23.350	103	26.410	106	26.424	109	26.439
101	26.390	104	26.414	107	26.430	110	26.444
102	26.400	105	26.418	108	26.434	...	.....
Pressure Angle, 20 Degrees							
12	4.596	30	10.751	48	16.909	66	23.065
13	4.610	31	10.768	49	16.923	67	23.080
14	4.624	32	10.780	50	16.937	68	23.092
15	4.636	33	10.794	51	16.950	69	23.108
16	4.652	34	10.806	52	16.965	70	23.120
17	4.666	35	10.822	53	16.979	71	23.134
18	4.680	36	10.836	54	16.993	72	23.149
19	7.646	37	13.803	55	19.959	73	26.115
20	7.660	38	13.814	56	19.971	74	26.130
21	7.674	39	13.831	57	19.987	75	26.143
22	7.688	40	13.845	58	20.001	76	26.157
23	7.702	41	13.859	59	20.015	77	26.171
24	7.714	42	13.870	60	20.030	78	26.186
25	7.730	43	13.887	61	20.041	79	26.199
26	7.744	44	13.901	62	20.057	80	26.212
27	7.758	45	13.915	63	20.071	81	26.227
28	10.724	46	16.881	64	23.037	..	.....
29	10.738	47	16.894	65	23.051	..	.....

Table 2. Number of Teeth Included in Chordal Measurement*

Tooth Range for 14 1/2 Deg. Pressure Angle	Tooth Range for 20 Deg. Pressure Angle	Number of Teeth to Gage Over	Tooth Range for 14 1/2 Deg. Pressure Angle	Tooth Range for 20 Deg. Pressure Angle	Number of Teeth to Gage Over
12 to 18	12 to 18	2	63 to 75	46 to 54	6
19 to 37	19 to 27	3	76 to 87	55 to 63	7
38 to 50	28 to 36	4	88 to 100	64 to 72	8
51 to 62	37 to 45	5	101 to 110	73 to 81	9

*This table shows the number of teeth included between the jaws of the vernier caliper in measuring dimension *M*, which is obtained as explained in connection with Table 1.

diametral pitch and a pressure angle of 20 degrees. A total backlash of 0.008 inch is to be obtained by reducing equally the teeth of both mating gears.

Table 1 shows the chordal distance for 30 teeth of 1 diametral pitch and a pressure angle of 20 degrees to be 10.751 inches; one-half of the backlash equals 0.004 inch. Hence,

$$\text{Chordal dimension} = \frac{10.751}{5} - 0.004 = 2.146$$

Table 2 shows that this is the chordal dimension when the vernier caliper spans four teeth, this being the number of teeth to gage over when gears of 20-degree pressure angle have any number of teeth from 28 to 36, inclusive.

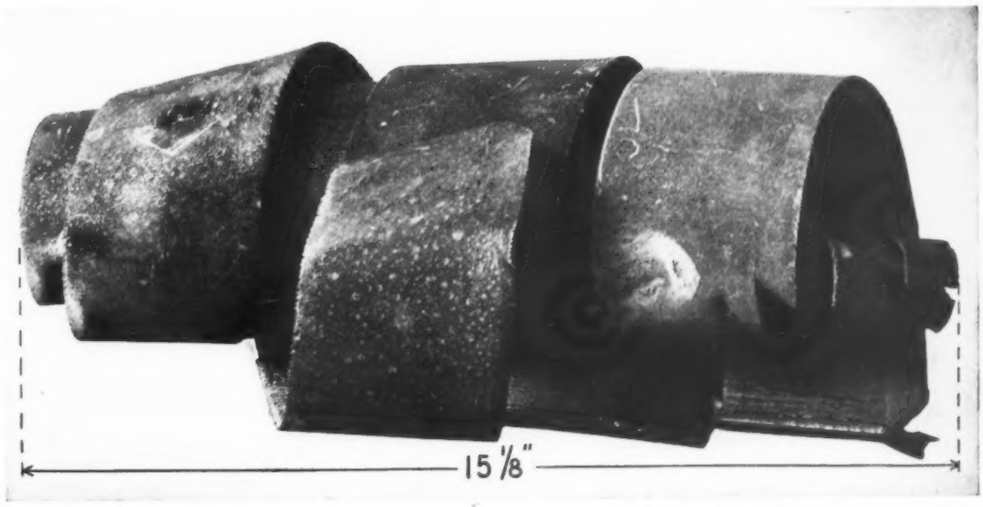
Amount of Backlash and Allowance for Finishing

While the total amount of backlash varies more or less for different installations, the range for general industrial gearing is ordinarily from 0.002 inch for 16 diametral pitch to 0.010 inch for 3 diametral pitch. If the pitch-line velocity exceeds 1500 feet per minute, these backlash values may have to be increased to 0.0035 and 0.013 in the range from 16 to 3 diametral pitch.

If it is necessary to leave enough stock on the gear teeth for a shaving or finishing cut, this allowance is simply added to the chordal dimension of the finished teeth to obtain the required measurement over the teeth for the roughing operation. It may be advisable to place this chordal dimension for roughing on the detail drawing to relieve the machine operator of any computation.

Since this method requires only a vernier caliper, the investment in gaging equipment is reduced to a minimum. The substitution of a simple snap gage might be justified for checking a long run of duplicate gears. The tables simplify the calculations, so that there is little chance of error, and odd tooth numbers do not present any special problem. If a gear is being cut by form-milling, gaging can begin as soon as the required number of teeth have been milled; or, in the case of gear-hobbing, the chordal dimension can be checked as soon as the hob has advanced far enough to form a full tooth profile. In checking gears by the pin method, such preliminary gaging is impossible. If the teeth are being milled, it is necessary to cut at least half of them so that pins can be inserted on opposite sides. When hobbing, the teeth must, of course, be finished to the point where there is adequate bearing surface for the pins.

The pin system has its advantages, especially in gaging comparatively fine pitches. The chordal system is particularly adapted to the machine tool field, where most of the spur gearing ranges from 2 to 12 diametral pitch. For these gears, the chordal method is believed to be just as accurate as the pin system is in its application to the finer pitch ranges. The chordal method is being used on high-class gearing for radial drill spindles (with speeds as high as 2000 revolutions per minute), lathe headstocks, and crank shapers. Gears for these different applications necessitate very careful machining for balance, concentricity, tooth spacing, finish, and backlash control, in order to procure relatively noiseless operation and prevent transferring tooth errors to the finished work.



An Unusual Planer Chip—Actually Two Chips Twisted Together—About 3 1/4 Inches Wide by 3/64 Inch Thick. Taken from a 130-pound Railroad Rail—Very Hard Material—on a Cincinnati Planer Co.'s Frog and Switch Planer

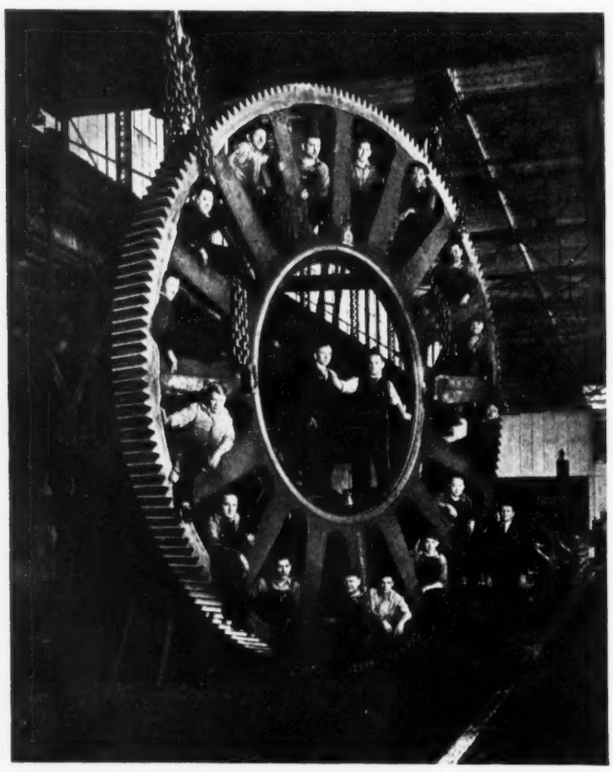
Engineering News Flashes

The World Over

Eighty-Three 20,000-Pound Jolts per Minute Separate Sand from Castings

For speedily and economically separating the sand from castings in large molds, the Everett steel foundry of the General Electric Co., Lynn, Mass., has installed a new machine which raises and drops a 20,000-pound mold eighty-three times every minute. The sand is shaken out of the mold and drops through a grating. Before the installation of the new machine, these large molds had to be picked up by a crane and the castings laboriously dug out.

The machine, of all-welded construction, is provided with a 20-horsepower gear-motor, which rotates a heavy shaft. On this shaft are three cams which lift and drop the ends of the shake-out beams successively. These beams are made from 24-inch I-sections, with 1- by 8-inch plates welded to both flanges and web stiffeners every 2 feet. The machine is mounted in a structural-steel frame which rests on a concrete foundation. The equipment was designed by the G. E. maintenance and engineering department in cooperation with the foundry.



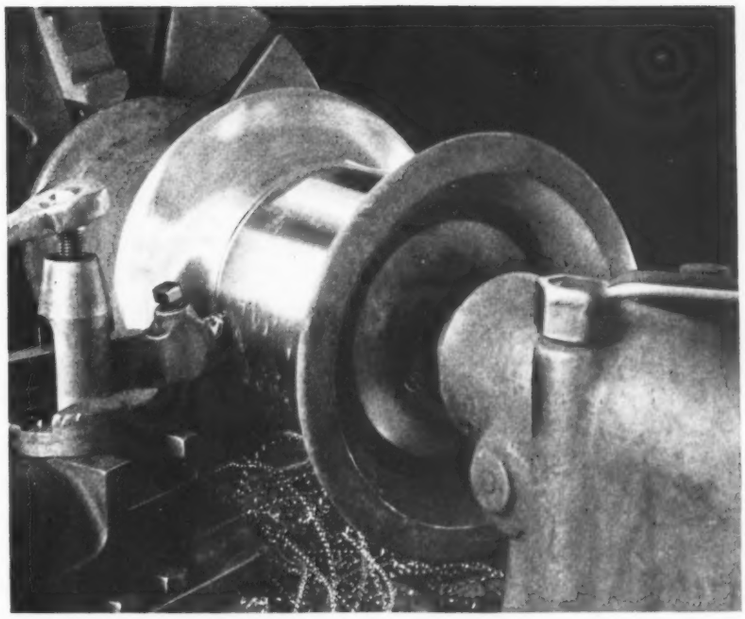
A Gear over 20 Feet in Diameter with an 18-inch Face Made in Halves from Steel Castings Weighing over 40,000 Pounds. The Gear will Transmit 1500 Horsepower at 18 Revolutions per Minute. It was Made by the Foote Bros. Gear & Machine Corporation, Chicago, Ill., for F. L. Smidth & Co., to be Used in a Cement Mill. Unusually Close Tolerances for This Size of Gear were Required. It Took Nearly Six Weeks to Machine and Cut the Gear

Duralumin Used as a Building Material

A small building 1500 feet from the summit of Mont Blanc, to be used as shelter for mountain climbers, has been erected from duralumin. The reason for selecting this alloy was that all the building material had to be carried by man-power for a considerable distance to the building site, and it was important to select a light material. The completed building weighs approximately 7.5 tons. Had it been built from stone, the weight would have been approximately 100 tons.

New Method of Making Tin Plate Reduces Tin Consumption

A patent has recently been issued to the Blaw Knox Co., Pittsburgh, Pa., on a new method of producing tin plate. This method is said to make it possible to produce a sound adherent tin coating with the use of less tin than required by previously used methods. The scope of the patent and the principle of the process are indicated by the following patent claim: "In a process for producing tin-plated steel strip, heating the strip to a temperature sufficiently high to anneal and temper the same, gradually cooling said strip while preventing contact with external air, joining portions of strip end to end to form continuous strip with good electrical contact at the joint, and moving the continuous strip uninterruptedly and at a substantially constant speed through the sequential operations of acid pickling, washing, electroplating in a tin bath in which the moving strip constitutes the cathode and passes between anodes distributed along the submerged portions of the strip, washing, and dry-



Turning an Alloy-steel Cat-head with Stellite J-Metal. This Cat-head, which is Used in the Oil Fields, is Preheated in a Furnace and Kept Hot During the Turning Operation by Means of an Oxy-acetylene Blowpipe

ing, said operations thus producing steel strip coated with an adherent and evenly distributed electro-deposit of tin."

English Steam Train Sets New High-Speed Record

A recent run of the London and North Eastern Railway's "Coronation" express, when a speed of 125 miles per hour was attained, is, according to the *Railway Gazette*, a world record for steam locomotives. The fastest steam locomotive speed previously attained was made on a test run between Berlin and Hamburg in Germany, where a speed of 124.5 miles per hour was attained.

Motor Maintenance at 16 Cents per Horsepower a Year

According to information obtained from the General Electric Co., data on a total of 13,000 horsepower, developed by electric motors ranging from fractional-horsepower motors up to units of 800 horsepower, and including direct-current, squirrel-cage, wound-rotor, and synchronous types, that have been in continuous operation for ten years, showed an average annual maintenance cost of 16 cents per horsepower. This average was compiled from the records of the Great Lakes Portland Cement Co., Buffalo, N. Y., and is based on the period from 1931 to 1937. The operation was twenty-four hours daily. If the operations had been on an ordinary eight-hour day basis, the maintenance cost would, of course, have been very much reduced. In these maintenance costs, the labor costs were twice the material costs.

New Cunard Liner "Queen Elizabeth" will be World's Largest Ship

The Cunard-White Star liner *Queen Elizabeth*, recently launched, is expected to make her first voyage across the ocean in 1940. This ship will be 1030 feet long, compared with the *Queen Mary's* 1020 feet. The gross tonnage will be about 85,000, against 81,235 for the *Queen Mary*. The ship is 118 feet wide and has fourteen decks. The height from the top of the main lounge to the keel is 120 feet. The length of the promenade deck is 725 feet.

The *Queen Elizabeth* will be driven by Parsons single-reduction geared turbines. Each of the four propellers, weighing 32 tons apiece, will be driven by an independent set of four turbines. The largest gears in each reduction set will be 14 feet in diameter. Steam will be supplied to the sixteen turbines by twelve high-pressure water-tube boilers in four boiler rooms. These boilers are the largest ever constructed for a ship and contain, in all, 71,000 tubes. The main steam piping will have a length of over 3000 feet. The boilers burn oil fuel, distributed in forty tanks, from which 4000 feet of piping will lead to the furnaces.

In addition to her propelling machinery, the *Queen Elizabeth* will have a separate power station for supplying electric light and power. This power station will have four turbo-generators delivering sufficient electrical energy to meet the lighting and public current requirements of an average town of 200,000 people. Thirty thousand lamps will be installed and 4000 miles of cable will be required to conduct the current. Apart from lighting, electric current will be needed for the kitchens, ventilating system, elevators, telephones and radios, etc.

A Lamp that Combines Bulb and Reflector in One Unit

A radically new type of Mazda lamp which includes a reflector inside the bulb has been developed by the Westinghouse Lamp Division of the Westinghouse Electric & Mfg. Co., at Bloomfield, N. J. These new lamps are made with a flared bulb, coated on the inside of the flare with metal which takes and retains a high polish and directs the light of the filament. The efficiency of the directed light is high, because the reflector has the accurate shape required and is located in the correct position relative to the light source.

EDITORIAL COMMENT

It is not necessary in this day and age to emphasize the overwhelming importance of modern mechanized equipment in present-day warfare. Our newspapers daily make reference to such equipment—fighting planes and bombers, anti-aircraft guns and new long-range artillery, tanks and automatic rifles. We hear less, however, about the nation's capacity for producing such equipment; yet this is the very crux of the national defense problem.

The leading article in this number of MACHINERY by Assistant Secretary of War Louis Johnson outlines the plan for intensive cooperation between Government and industry which is part of the War Department's Defense Program. The figures quoted in the article indicate the magnitude of the program and the immensity of the task that the War Department has set for itself. The article emphasizes the importance of the machine tool and the small tool industries in the Defense Program, and gives evidence of the fact that this importance is fully recognized by the officials who guide the policies of the War Department.

Preparedness—a Big Task for the Nation's Industries

It is one thing to design and make a single plane or gun or tank, but quite another thing to produce these in sufficient quantities to provide adequate protection for this great country. Shop capacity and engineering skill at once become the important factors. It is no empty phrase, but a highly significant fact, that the *machine shops of the country constitute its first line of defense.* Properly organized, the machine shops can make our defenses impregnable; inadequately organized, the nation would be helpless in time of war.

In view of this, the importance of arranging in advance for manufacturing methods and machines, tools, and gages, cannot be too greatly stressed. Industry has a big task ahead of it in carrying its share of the responsibility for the satisfactory fulfillment of the War Department's plans. Industry must provide not only the machines and tools to carry this program forward properly, but also an adequate supply of trained men—toolmakers, machinists, and operators—capable of making the tools and gages, building the machines, and operating the equipment required to carry through the National Defense Program to completion.

The Machine Shop—the Country's First Line of Defense

The Government's effort to provide effective industrial mobilization is no indication that the American people are giving way to militarism; but in a world where solemn obligations and treaties have been shown to be mere "scraps of paper," it is only common sense for this nation to prepare to defend its historic freedom and be ready to resist intimidation and aggression.

In a well-known popular magazine of wide distribution, it was recently stated that men over forty years of age find it difficult to get jobs because the modern machine supposedly runs so fast that a man of forty cannot keep up with it. This is interesting news in view of the fact that the automobile industry employs so many men over forty years of age. If the machines are running too fast for men over forty in any industry, they certainly must run too fast for men of that age in the automobile industry, where production methods are so highly developed.

Now the Machine Runs Too Fast for Men Over Forty

When confronted with these general statements, unsupported by data, it is interesting to examine the facts. A survey of the hourly paid workers in the factories of members of the Automobile Manufacturers Association in January, 1938, shows that 21 per cent of the men on the payrolls were *forty-five* years of age or over; yet the idea that men over forty are not useful in industry dies hard.

Perhaps the facts will be more impressive if, instead of percentages, we use actual figures of the number of men over forty employed in the automobile industry. There are just about 100,000 men of that age and over in our automobile plants. Evidently, they must be a very select group, since they are obviously able to keep up with the modern machine "that runs so fast that a man of forty cannot keep up with it."

How to spread correct information about the machine and its place in modern life, and to combat the misinformation so generally published, is one of the important tasks of industry.

Ingenious Mechanical Movements

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and Other Devices

Special Drilling Machine for Small-Lot Production

By ROY T. COYLE

In tooling up for the production of a limited number of large Diesel engines, it was found advantageous to build two special semi-automatic drilling machines. These machines, operated by one man, perform all the angular drilling operations required in several parts of a similar design. The machine shown in Fig. 1 is designed to drill sixteen 3/32-inch holes in the piston shown at *W*. The holes are located in two rows around the periphery of the piston, as indicated at *T*, Fig. 2, and are equally spaced and drilled at an angle of 10 degrees with the axis of the piston.

The special machine shown in Fig. 1 consists of a No. 989 Delta drill press *A*, hooked up to an indexing device and mounted on a steel base. The piston is located on an arbor *B* and clamped securely by a tapered block *C*. The operator starts the drilling cycle by pushing a button. The arbor carrying the piston then moves through an intermittent rotating cycle until all sixteen holes are drilled.

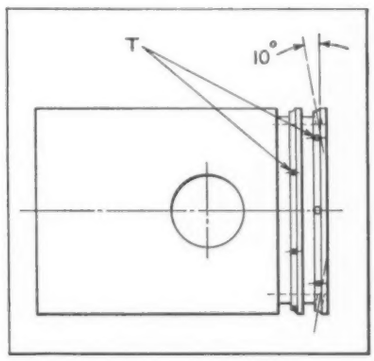


Fig. 2. Piston in which Sixteen 3/32-inch Holes are Drilled

The indexing and the drill-feeding mechanisms are driven by a 1/4-horsepower motor *D* through a speed reducer *E*. Two properly synchronized

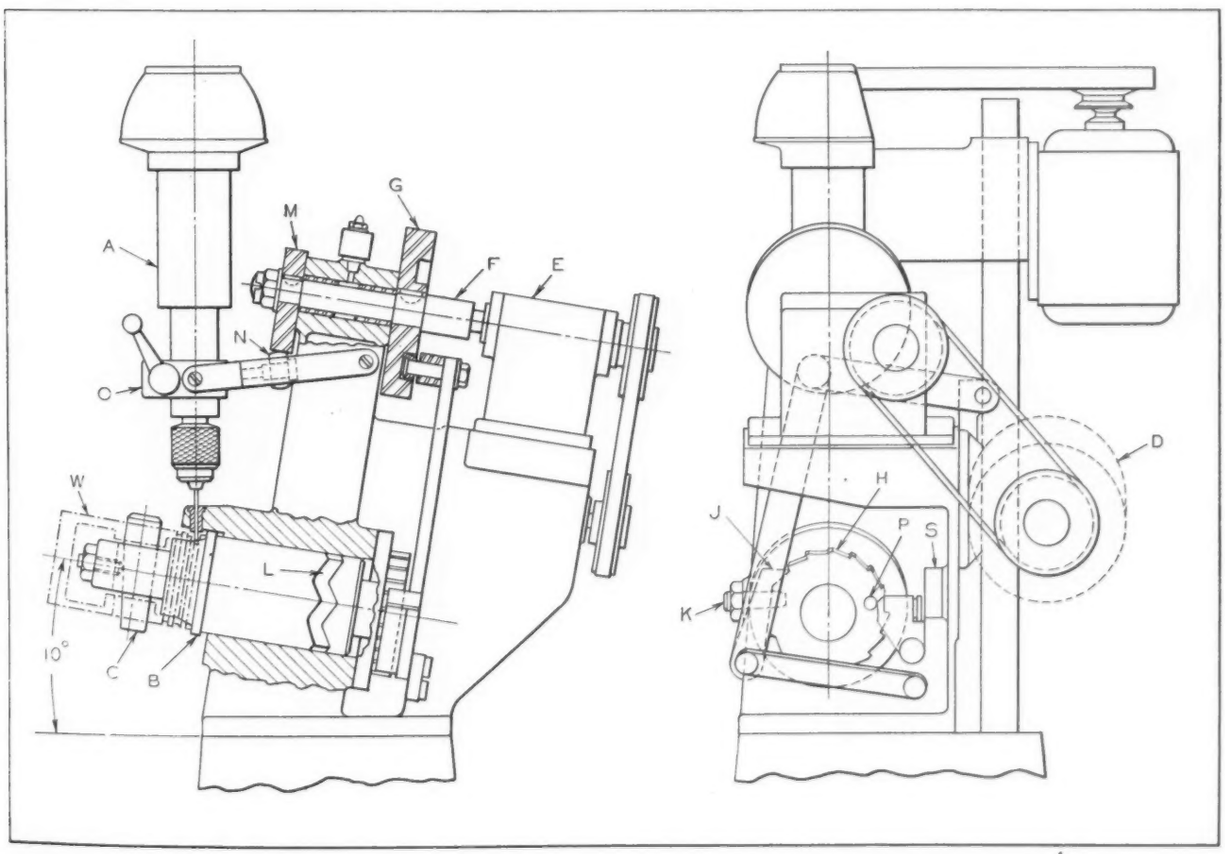


Fig. 1. Special Piston-drilling Machine with Automatic Indexing and Feeding Mechanism

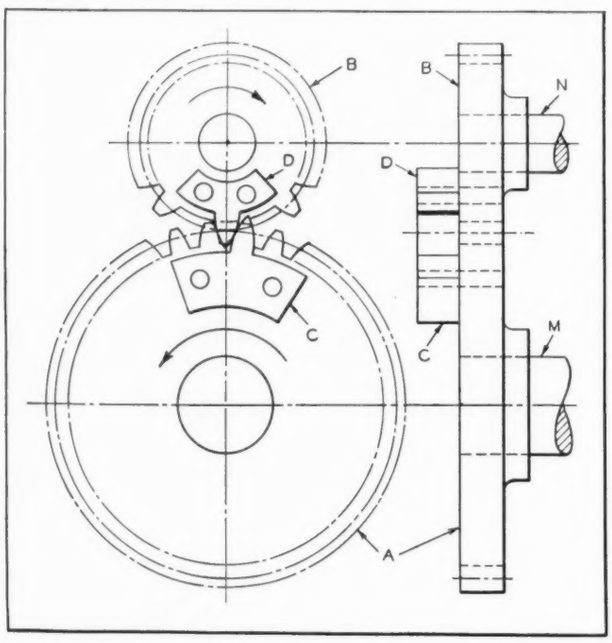
cams *G* and *M* are mounted on the camshaft *F*. The grooved face-cam *G* actuates the ratchet *H* through pawl *J*, thus indexing the work as required for the angular spacing of the holes. A fixed plug *K*, engaging the cam groove *L* milled on the periphery of the work-arbor, causes the latter member to move in and out as required for drilling the two rows of equally spaced holes. The cam *M*, actuating the roller *N*, imparts the required feeding movement to the drill. The collar *O* can be adjusted to compensate for drill wear. A pin *P*, which is located on the ratchet wheel, comes in contact with a micro-switch *S*, thus stopping the machine automatically after the last hole in the piston has been drilled.

Intermittent Drive Mechanism

By L. KASPER

The intermittent drive shown in the accompanying illustration is incorporated in the design of a machine used in manufacturing a wire product. The two shafts *M* and *N* are required to rotate in opposite directions. Shaft *N* must make a complete revolution while shaft *M* makes one-half of a revolution, shaft *N* remaining stationary while the other shaft completes its revolution.

Gear *A* on the driving shaft *M* meshes with the gear *B* on the driven shaft *N*, the latter revolving at twice the speed of the former. Gear *B* has three teeth removed at one point where it receives no motion from gear *A*. The single teeth *C* and *D* are fastened to the outer sides of gears *A* and *B*, respectively, so that they make contact with each other and transmit motion the same as the regular teeth.



Mechanism that Permits Shaft N to Remain Idle During One-half Revolution of Driving Shaft M

When teeth *C* and *D* are in contact, the rotation of gear *A* in the direction indicated by the arrow produces rotation of gear *B* in the opposite direction. Gear *B* receives its motion from gear *A* through teeth *C* and *D* until gear *B* is rotated sufficiently to bring the standard teeth into mesh. The single teeth are made slightly longer than the standard teeth to insure contact without danger of clashing. When the standard teeth have made contact, rotation of gear *B* continues until the space from which the teeth have been removed permits the teeth of gear *A* to pass, at which time the rotation of gear *B* is discontinued. At this time, tooth *C* is 180 degrees from the contact point with tooth *D*, so that gear *B* remains stationary until gear *A* has completed its revolution and teeth *C* and *D* are in contact again.

Linkage Mechanisms for Operating Slide and Plunger Simultaneously

By F. H. MAYOH

The linkage arrangements shown in Figs. 1 and 2 are designed for advancing a slide and a plunger simultaneously during the first part of their movements, and then stopping the slide while the plunger continues to advance. The object of the devices illustrated is to advance the lower slide *A* for a distance *B* and then continue to advance plunger *F*. Slide *A* carries a receptacle *C* containing a sheet of paper *D* from a cut-off position to an operating position within the machine.

Resting on top of the slide is a cylindrical-shaped piece *E* which is carried along simultaneously by the plunger *F*, attached to another slide unit *G*. Plunger *F* also pushes piece *E* through the paper-holding receptacle *C*, and in doing so, causes the paper to be wrapped about the piece. The chute *H*, Fig. 1, leads from a hopper which furnishes a continuous supply of the parts to be wrapped.

A portion of the machine frame is shown at *J*. A bracket *K*, mounted on the frame, carries the dual slide mechanism. A lever *L* is employed to operate the slides. This lever is actuated by a cam *M* and a co-acting lever *N*, mounted on the rocker shaft *P*. Up to this point the mechanisms illustrated in Figs. 1 and 2 operate in a similar manner.

Referring to Fig. 1, the upper end of lever *L* is attached to a link *Q* which moves the slide or plunger *F*. Attached to the lower sliding unit of which *A* forms a part, is a spring cushion link *R*. This link is connected to a block *S*, the pivot points being at *T* and *V*. When slide *A* is advanced a distance *B*, block *S* comes in contact with the stop-screw *W*, which prevents the lower slide from advancing beyond this position. At this point the spring cushioning mechanism comes into effect and

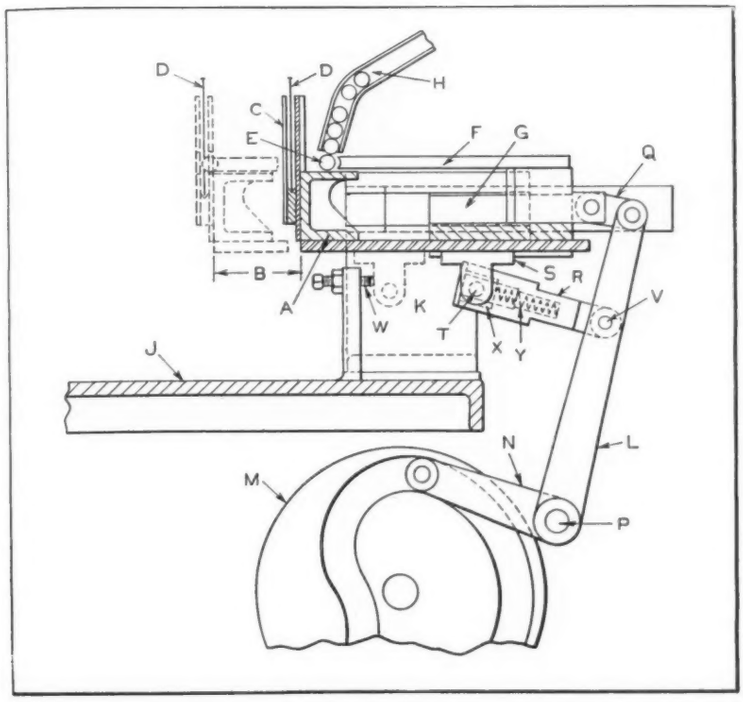


Fig. 1. Link Mechanism Designed to Operate Slide A and Plunger F Simultaneously

permits the lever *L* to continue advancing. The continued movement of the upper slide and plunger *F* carries the cylindrical piece into the machine.

The spring cushion consists of a movable block *X* in which the stud *T* pivots. This block slides in the connecting link *R*, while the spring at *Y* holds the sliding block in the position shown. As lever *L* advances, block *X* slides along the connecting link *R*, thereby compressing spring *Y*. Interrupted advance linkages requiring the compressing of a spring of sufficient stiffness to advance a slide mechanism introduce into the machine what may be termed a harsh movement and one that may pound and wear out the mechanism quickly, with an attendant loss of power. To eliminate this action, the lower slide connection was redesigned as shown in Fig. 2.

The lever *L*, Fig. 2, is fitted with an extension *X* which supports a roll *Y*. Fastened to the under side of the slide bracket is an open cam *Z*. The contour of this cam is so designed that the roll will follow the angular portion of the cam indicated by the arrows at *Z* without advancing the lower slide after it has been advanced the required amount, although the upper slide and work pusher or plunger *F* continue to advance. It is obvious that the smoother action of the open cam *Z* will permit the moving parts to travel at a faster rate than is the case with the construction shown in Fig. 1.

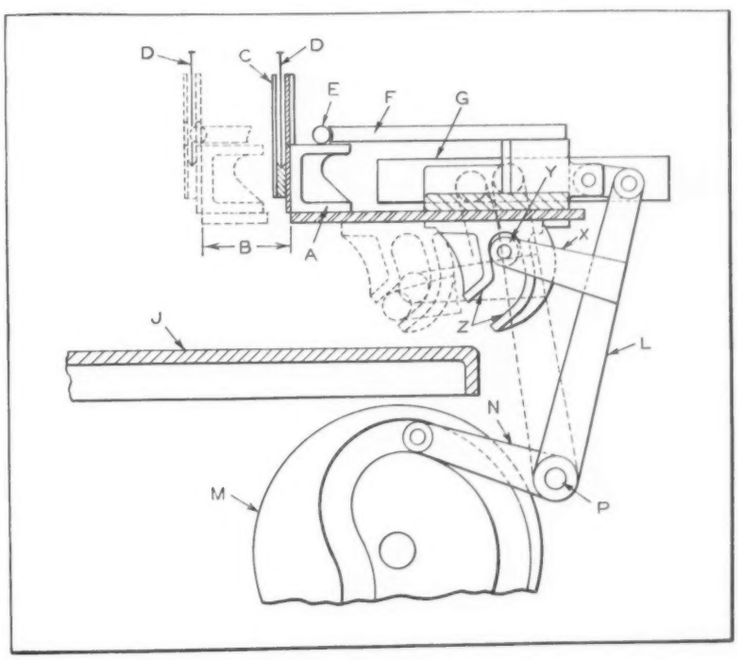


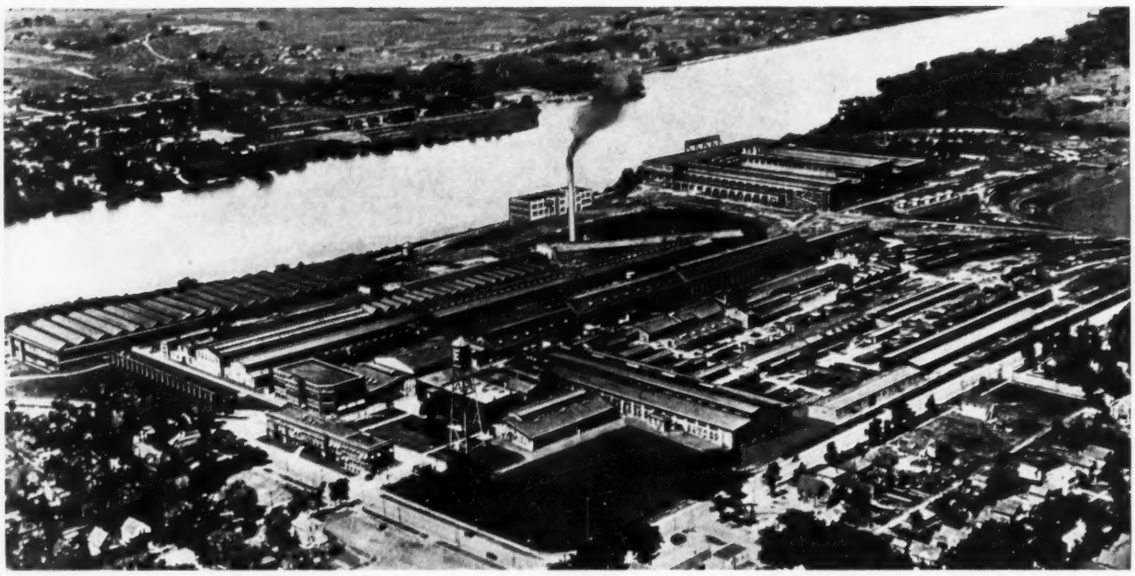
Fig. 2. Mechanism Shown in Fig. 1 Redesigned to Give Smoother Action

How Advertising Creates Employment

In commenting upon the important part played by advertising in increasing the sales of manufactured products and thereby increasing employment, the Bureau of Research and Education of the Advertising Federation of America mentions that electric clocks were first put on the market as a regular manufactured product in 1928; but in that year comparatively few were sold. Shortly afterward, the business depression began; in spite of it, however, large advertising campaigns were launched and sales mounted steadily. In 1937, about 3,000,000 electric clocks were sold, and now nearly half of all the homes supplied with electricity have one or more electric clocks. Jobs have been made for hundreds of workers. It could not have been done without advertising.

The radio industry had hardly been started fifteen years ago. Now it employs thousands, and 25,000,000 homes are equipped with radio sets. This miraculous growth has been due in great part to advertising. The huge automobile industry presents a brilliant advertising achievement. Automobile manufacturers credit the use of advertising with the swift climb to tremendous sales. Engineering excellence alone is not enough.

In many other fields we see companies and whole industries that have grown large by the help of advertising and made many more jobs for workers.



The Beloit, Wis., Plant of Fairbanks, Morse & Co.

Apprentice Training—An Essential to Industrial Progress

Advanced Ideas on Industrial Training, Expressed by the Director of an Apprentice System which is Fitting Young Men Successfully for Future Responsibilities

By A. R. LUEBKE, Supervisor of Apprentices
Fairbanks, Morse & Co., Beloit, Wis.

FAIRBANKS, MORSE & CO. is one of America's pioneer organizations, having more than a century of manufacturing experience and progress behind it. Many of the products of this company require precision manufacturing methods; hence, highly skilled workmen are needed and an established plan of developing them is essential.

To develop an apprentice system satisfactorily, a modern manufacturing plant with an established product is essential. The Beloit plant of the Fairbanks-Morse company meets this requirement unusually well. It produces Diesel engines ranging in size from one to ten cylinders and in rating from 10 to 1400 horsepower. To date, it has completed Diesel engines totalling nearly 3,000,000 horsepower. It also manufactures electric generators and motors from 1/2 to 10,000 horsepower; steam and power pumps capable of pumping against 10,000 pounds pressure; and centrifugal type pumps delivering up to 150,000,000 gallons of water per day.

Home appliances, such as refrigerators, radiators, air-conditioners, and fuel stokers, as well as industrial and farm engine magnetos, light oil and gas engines, automatic water systems and windmills, are also among the products of the company. The plant covers sixty-seven acres of ground and normally employs between 3000 and 4000 people. It has one of the largest gray-iron foundries in the world, with over 250,000 square feet of space under one roof.

Another plant of the company makes weighing equipment ranging from delicate automatic recording scales to 200-ton railroad track scales, and various types of railroad equipment.

This brief resumé of the company's manufacturing activities will indicate why it is in a position to train apprentices in many varied lines of mechanical work.

With few exceptions, the plan of apprentice training employed by this concern is similar to that used by other plants in Wisconsin. Our company,

however, limits this training to boys who have graduated from high school. The reason for this is that the firm expects to select its supervising staff, in the future, from among men who have had this apprentice training. Experience indicates that foremen and superintendents so trained, who also have an adequate general education, make the best supervisors. In the apprentice course, the young men continue their school training, being given instruction in mechanical drawing, cost and production control, tool design, shop mathematics, etc.

Great care is taken in the selection of eligible young men for this course. It is of the greatest importance that the applicant have the proper traits and characteristics for the exacting requirements of the mechanical industries.

Six Traits Expected in the Young Man Entering the Apprenticeship

There are six traits or characteristics that this company considers necessary in the young men entering its apprentice course. These are (1) interest, (2) ambition, (3) scholastic ability, (4) carefulness, (5) determination, and (6) courtesy. In the following, we will examine briefly the reasons why the Fairbanks-Morse company insists upon these characteristics.

First, the applicant must be interested in his work and know why he prefers this type of work, or why he thinks he is fitted for it. The practical courses given in high schools make it possible for most boys to find out if they are interested in mechanical work. This plant has several apprentices who entered the patternmaking classes in high school; their determination to follow this trade after graduation has enabled them to make rapid progress. This is also true of several apprentices who entered the toolmaking, machinist's, and other courses. For this reason, we prefer a young man who is already interested in the work when he makes an application to enter the apprentice course, who knows what he wishes to accomplish, and is eager to learn what he is being taught.

The second characteristic desired is ambition. It is useless to teach a trade to a young man unless he has ambition and is willing to work to get ahead. We do not want to start any young man in our training courses who has not this important characteristic. The country is full of men who know enough to earn what they consider a living wage, but who lack the ambition to advance further; consequently, we have an over-supply of common labor and a shortage of skilled mechanics. To overcome this difficulty, industry must turn its attention to finding ambitious young men to train.

We are interested in the scholastic standing of the apprentice, which we secure from the high school where he graduated. The boy proficient in mathematics, especially geometry and trigonometry, is likely to make good use of this knowledge as a toolmaker or tool designer. The scholastic standing is also an indication of the young man's interest and ambition in general.

Neatness in Appearance is Usually the Sign of a Careful Workman

The fourth trait that we look for is carefulness. In a plant of 3000 men, there are always a number of accidents, although there is constant vigilance to reduce and prevent them. Every firm spends large sums of money on safety devices and provides protective equipment, but this alone is not enough to prevent accidents due to carelessness. Hence, we wish, as far as possible, to select only young men for training that we have reason to believe are going to be careful. Personal appearance is an indication of carefulness. We have found that the indifferent workman is invariably indifferent in appearance. By neatness in appearance we do not mean that the boy should be immaculately dressed; it is rather the way in which he carries himself and the manner in which he answers questions that determine whether he is the type of boy we want.

The fifth point to consider in selecting a young man is his determination, or, if you wish, "backbone." We want the type of boy that can be depended upon to finish a job, once he has started it. It does not pay to train young men who will not finish their course. Usually we try to obtain sons of employes, for, if their fathers have been good workmen, they are often likely to show the same traits. Of course, there are exceptions; but, as a rule, the influence of a dependable father on his son is apparent.

Courtesy is an Essential Even in Mechanical Work

The sixth and last characteristic is courtesy. This is essential. These boys are expected to become future executives; they will not succeed if they do not understand what is meant by courtesy or if they do not show respect for their superiors and fellow workers during their training period. Frequently, one finds that the discourteous boy will evade shop rules, as well as the authority of his immediate superiors. There is no place for that type of boy in industry. Courtesy is an invaluable asset to a young man who expects to succeed.

The writer, having had twenty-five years' experience in industry, occupying positions ranging all the way from apprentice to superintendent, believes that these characteristics are essential to a good mechanic. Nor are these qualities at all rare in our American boys. They are found in most of the bright young fellows who make application to enter apprenticeship courses.

A Few Features of the Fairbanks-Morse Apprentice Plan

At the present time, the Beloit plant of Fairbanks, Morse & Co. employs close to 3000 men. There are somewhat less than 100 apprentices in the plant. Of these about one-third are machinist apprentices, and about one-sixth toolmaker apprentices. The others are divided between the pattern

shop, foundry, blacksmith shop, heat-treating department, sheet-metal shop, welding shop, and tool design department, with a special group devoting themselves to Diesel engines and one or more to motors and generators.

According to the Wisconsin law, every apprentice must spend four hours a week in a vocational school, where he studies shop mathematics, including geometry and trigonometry, and mechanical drawing. The supervisor of apprentices makes weekly visits to the vocational school, spending several hours each week in the classrooms. In this manner, he is in constant touch not only with the apprentices, but also with their instructors in the school, as well as with their foremen in the shop.

The Wisconsin University Extension Division also offers a great opportunity to the apprentice at a small cost—an opportunity of which most of the boys take advantage. Through this extension division they are able to take advanced courses in mechanical drawing, mathematics, chemistry, etc. Most of the boys enrolled in the Diesel engine apprentice course are enrolled with the university, taking courses that will enable them to obtain university credits. They intend to become mechanical engineers and are planning to attend the university after graduating from their apprenticeship.

The shop training of the apprentices follows somewhat similar lines to those of other well-organized apprentice systems. The boys are given an opportunity to get a complete training in the particular trade they have chosen.

Fairbanks, Morse & Co. has a long and enviable record of successful apprentice training, both in the original plant of the company at St. Johnsbury, Vt., and in the Beloit plant. In this connection, it is of considerable interest to note that Charles Hosmer Morse, Sr., whose name is one of the two that make up the corporation name, and who was born in St. Johnsbury, Vt., in 1833, was the first apprentice of the original E. & T. Fairbanks Co. of that town, which company later became a part of the present Fairbanks, Morse & Co. He served a three-year apprenticeship at $50 a year. Subsequently he became connected with the sales organization and established his own firm, which was finally merged with the original company.

Two Questions About Apprentice Training Answered

Two questions are often raised in connection with apprentice training: "Is it possible to obtain a sufficient number of desirable boys for training annually?" "Does the average American boy want to go into a machine shop?" Just why these questions are raised the writer does not know. There is really only one answer to both. It has been the writer's experience, and that of the firm with which he is connected that there is always a surplus of desirable boys anxious to learn a good trade. Our company has a very long waiting list. We are able to take in only from thirty to forty boys annually. These we select from a list of unusually good applicants numbering over one hundred. We have several hundred additional applications.

Usually, firms that find it difficult to obtain good material for apprentice training are either located in very large cities, where the mechanical industry is not so highly thought of as it is in our smaller industrial centers, or they have not created such a reputation for their apprentice training as would make it seem desirable for a young man to become employed by the company.

Another question asked is this: "Is it not rather expensive to train an apprentice?" To this I would answer that the apprentice course is not a direct money-making plan. At first the boy's training costs more than the value of his accomplishments; but the return is never obtained from any investment until the investment has been made. Consequently, there is no return from the training until the young man has learned how to do acceptable work in one or more departments.

In the long run, however, there is no question but that the apprentice training system is one that is profitable both to the firm and to the young man being trained. It is usually a mutually satisfactory investment. We have had instances where men have left our employ who could not be immediately replaced, and an apprentice has stepped in to fill the place acceptably. Furthermore, from the ranks of their apprentices, many firms are now filling their needs for supervisors. Our company is doing this to some extent today and expects to do it to a greater extent in the future. Apprentice training is one of the basic needs of American industry, if it is to maintain its high place in competition with the rest of the world.

* * *

Motion Pictures Tell the Story of the Production of Copper

Four new educational motion picture films, made under the supervision of the Bureau of Mines, U. S. Department of the Interior, in cooperation with one of the large mining companies, tell in an interesting manner the story of the production of copper. The four films are entitled "Copper Mining in Arizona," "Copper Leaching and Concentration," "Copper Smelting," and "Copper Refining." The first one of these is a three-reel film; the others are one-reel films. Copies of these films in 16- and 35-millimeter size are available for use by business and engineering organizations, colleges, etc. Applications should be addressed to the Bureau of Mines Experiment Station, 4800 Forbes St., Pittsburgh, Pa., stating the width of film desired. No charge is made for the use of the film, but the exhibitor is expected to pay transportation charges.

* * *

With money cheap and credit plentiful, why not permit American industry to prime its own pump? —*The Houghton Line*

Shaving, Piercing and Broaching Operations on a Thin-Section Die-Casting

By JOHN MARKSTRUM, Chief Engineer
Continental Tool Division
Ex-Cell-O Corporation, Detroit, Mich.

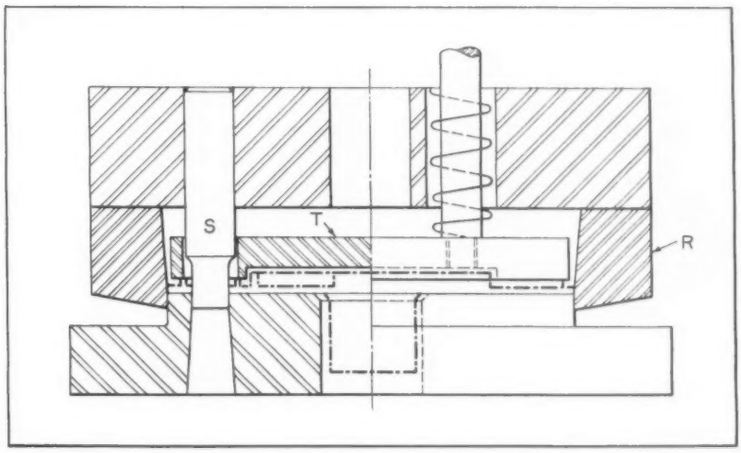


Fig. 2. Combination Shaving and Piercing Die which was Designed for Machining the Die-casting Shown in Fig. 1

OPERATIONS that are simple enough when performed individually on a part often introduce difficulties when combined with other operations in order to establish high-production methods of manufacture. In the case of the die-cast radio part illustrated in Fig. 1, for example, it would be comparatively easy to finish the periphery in one operation and machine each of the fifteen holes *A* individually from solid stock, producing holes with accurate serrations. However, this job became much more complicated when it was decided to shave the periphery of the part and pierce the fifteen holes in one operation, and broach the serrations simultaneously in the fifteen holes in a second operation. These operations had to be performed without distorting the work, which is a zinc die-casting having a rib only 0.065 inch thick between the bosses.

The die equipment shown in Fig. 2 is used for the first operation. The work is located in the die from the central hole, as indicated by the heavy dot-and-dash lines, and is located radially from lug *B*, Fig. 1, which is placed over an anvil insert in the die. The circular punch *R*, Fig. 2, shaves the periphery of the work and also lug *B*, Fig. 1. At the same time, holes *A* are pierced through solid stock to a diameter of about 7/16 inch by fifteen punches of the design illustrated at *S*, Fig. 2. These holes are pierced somewhat smaller in diameter than the tops of the serrations which are later to be broached, thus insuring that the broaches will remove any roughness remaining after the piercing operation has been performed.

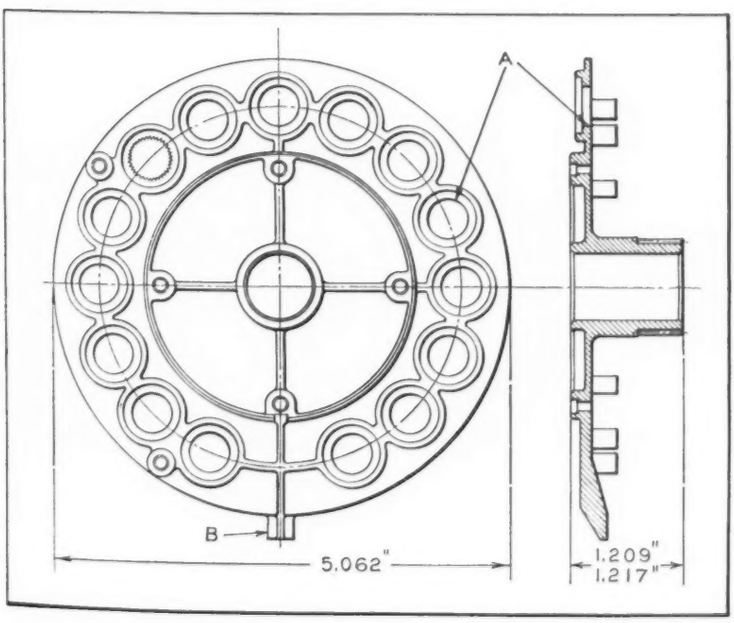


Fig. 1. Zinc Die-casting which has the Periphery Shaved and Fifteen Holes Pierced through Solid Stock in One Operation

On the return stroke of the press ram, stripper plate *T* forces the thin, flexible piece of work from the piercing punches without causing any distortion. The punches can be removed easily for sharpening. This equipment is used on a regular punch press.

The hole broaching operation is performed on a vertical broaching press with the equipment shown in Fig. 3. Each of the fifteen broaches *U* is provided at the lower end with a chamfered pilot that insures proper entry of the broach into the hole pierced in the preceding operation. Five circular teeth immediately in back of the pilots finish the holes to the root diameter of the serrations. Seventeen serrating teeth then broach forty-two serrations around each hole. These broach teeth are designed to offer minimum resistance when the broaches are pulled up through the work on the return stroke of the machine.

With each broach cutting forty-two

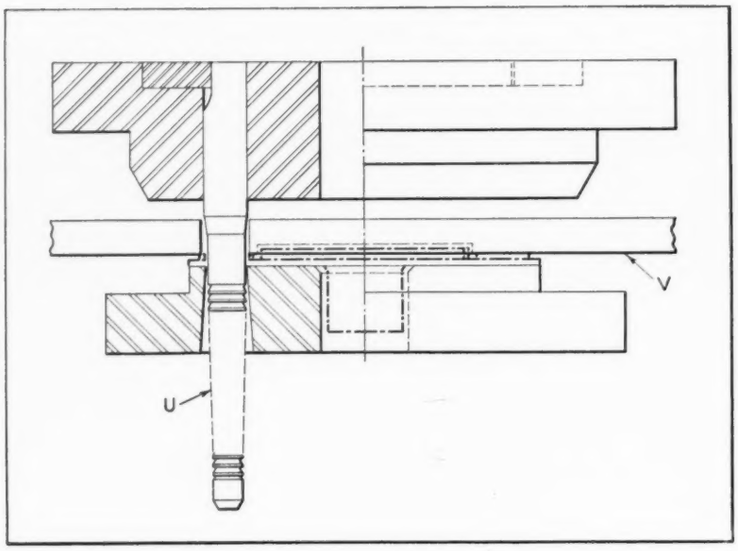


Fig. 3. Diagrammatic Illustration of Broaching Equipment Used for Serrating Fifteen Holes in the Die-casting Shown in Fig. 1

serrations, 630 serrations are broached at each operation. These serrations must all be straight, because any binding of a broach on the return stroke would cause mutilation of the serrations and possible breakage of the fine broach teeth. In setting up the broaches, the serrating teeth must be located in proper angular relation with respect to lines radiating from the central hole in the work. Guide bars insure proper alignment of the broaches and work with each down stroke of the machine. Stripper plate *V* forces the work from the broaches on the up stroke of the press.

* * *

An Inquiry into the Effect of the Machine on Employment

The American Society of Tool Engineers has announced that it will engage in a fact-finding investigation to determine the effect of the machine on employment and the standard of living. The general chairman of the committee having this inquiry in charge is John M. Younger, professor of industrial engineering, Ohio State University. Several sub-committees will be appointed, the work of some of which is already under way. It is recognized that the task of recording and correlating the facts is a big one. The active cooperation of numerous independent bodies in the carrying out of this fact-finding program will be invited.

* * *

In 1905, an Oldsmobile car, familiarly known as the "Old Scout," made a run from New York City to Portland, Oregon, in forty-four days. Considering the conditions of the roads in those days, this was a much heralded performance.

Caring for Acetylene Equipment in Cold Weather

The Linde Air Products Co., 30 E. 42nd St., New York City, has published a forty-page booklet entitled "Cold Weather Care of Acetylene Generating and Distributing Equipment." This booklet contains detailed instructions for preventing freezing of acetylene generators, hydraulic back-pressure valves, distribution piping and hose, regulators, relief valves, and water-cooled blowpipes, as well as suggestions on the procedure to follow if freezing has occurred. It is evident that, as water is essential in the operation of acetylene generators and distribution systems, such equipment should be given special care during the season when freezing temperatures prevail. The freezing of water may cause considerable damage which may result in leaks and in the formation of dangerous air-acetylene mixtures. All possible precautions should, therefore, be taken to prevent freezing; and if freezing does occur, it is of vital importance that steps to prevent serious damage be taken quickly.

* * *

Possible Change in Federal Price Policy

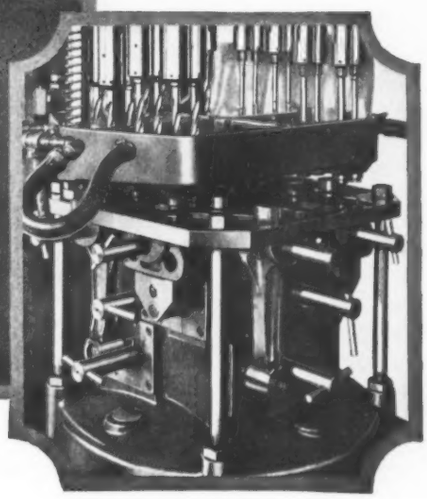
A booklet entitled "The Coming Change in Federal Price Policy" has recently been published by Allen W. Rucker in collaboration with N. W. Pickering, president of the Farrel-Birmingham Co., Inc., Ansonia, Conn. It is believed by the authors that the work of the National Economic Committee, sometimes termed the "O'Mahoney Anti-Monopoly Committee," is in all likelihood a prelude to attempted federal control of industrial pricing policies. As such, it represents the first move in a basic change of federal policy with respect to all prices. The authors state that the price-raising efforts have been overtaken by economic realities and must be abandoned. The booklet examines thoroughly into the various phases of this important subject.

* * *

Tool Engineers in Rockford Meet

The Rockford Chapter of the American Society of Tool Engineers held a meeting at the Hotel Faust, Rockford, Ill., December 8. At this meeting, the chief address was given by Lieutenant-Colonel A. B. Johnson, Ordnance Department, United States Army, on the subject "What Methods of Production will be Used by the Government in Case of War?" Lieutenant-Colonel George S. Clarke gave an address on "Living in the Philippines."

Design of Tools and Fixtures

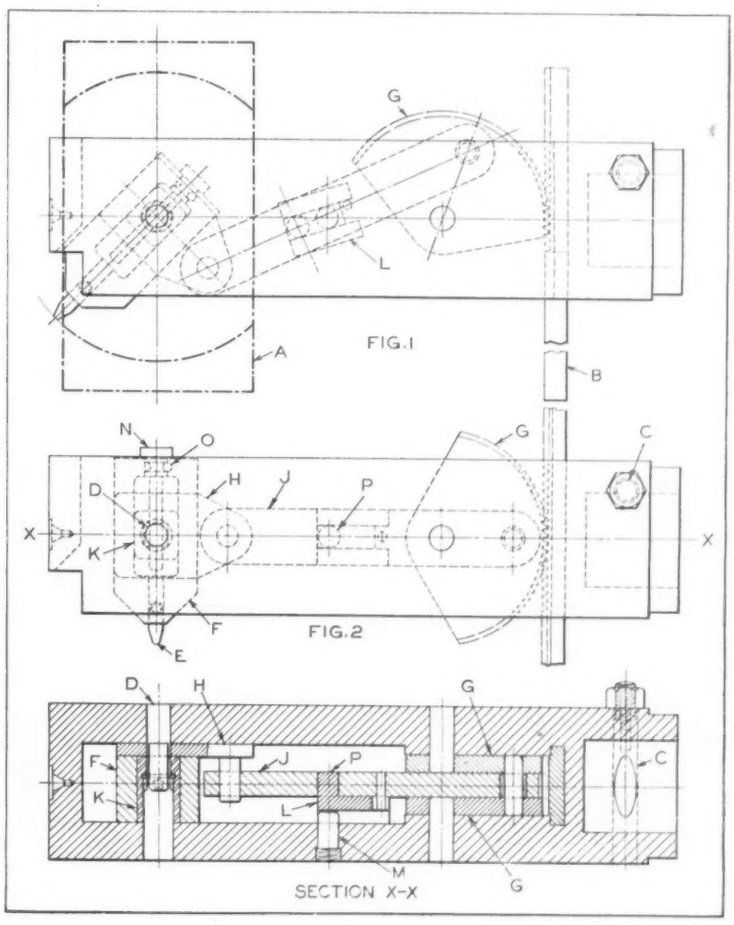


Lathe Attachment for Boring Ball-Seats

By CHARLES LAMB, Scotia, N. Y.

The main feature of the ball-seat boring device shown in the accompanying illustration is its capacity for swiveling the boring tool through an arc of 90 degrees. Another desirable feature is the adjusting means provided for the tool-holder, which permits taking cuts of micrometer precision. The device is mounted between the centers of a lathe, the headstock center being fitted into the center at the left-hand end of the device. The tailstock center is removed, so that the bored end of the device can be fitted over the tailstock spindle and clamped in place by bolt *C*. The bored hole in the end of the attachment is a good sliding fit on the tailstock spindle. The hole for bolt *C* is drilled and reamed and the bolt inserted in place before the hole is bored for the tailstock spindle.

The rack *B* is fastened in the tool-holder on the cross-slide. The work *A*, Fig. 1, is held in the lathe chuck, care being taken to see that the center pin *D*, Fig. 2, is in the exact center of the spherical surface to be bored. The tool bit *E* should be set so that it is exactly the same height as the lathe center, and it should be in line with the center of the tool-holder *F*.



Figs. 1 and 2. Ball-seat Boring Attachment with Provision for Swiveling Tool through an Angle of 90 Degrees

The rack *B* meshes with quadrants *G* which are connected to the tool-holder driver *H* by link *J*. The tool-holder driver has a square hole which is a press fit on the squared part of the center pin *D*. The rectangular-shaped block *K* is also pressed on the center pin, but is a sliding fit in the tool-holder *F*.

When the cross-slide of the lathe is fed in, the rack also travels in, and by the action of the link *J* rotates the tool-holder *F* from right to left. In Fig. 1 the tool-holder is shown at the extreme left, whereas Fig. 2 shows it located on center. Guide block *L* is used to carry the link around the dead center. The guide block has a

turned end *P* which is a turning fit in the link *J*. The under side of the guide block has a groove which is a sliding fit on the pin *M* in the body of the attachment. Pin *M* must be in accurate alignment with the turned part of the guide block when the link is on dead center.

The guide block should be located on the link so that it will have as limited a swing as possible when the tool travels from dead center in either a clockwise or a counter-clockwise direction. In the case of the device illustrated, the two end holes in the link are exactly 12 inches apart, and the hole for the guide block is 4 7/32 inches from the hole in the left-hand end of the link. This proportion will be correct for fixtures of any size.

The depth of the cut is adjusted by the feed-screw *N* which is fitted in a tapped hole in the guide post *D*. The feed-screw is held in place in the tool-holder by the pin *O*. The head of the feed-screw is slotted to fit a socket-head screw wrench and the rim of the head is graduated to read in thousandths of an inch. This attachment is used to bore out ball-seats that must be accurate within 0.002 inch.

Making a Spherical-Shaped Shell

By M. J. GOLDSTEIN, New York City

The spherical-shaped shell shown at *E*, Fig. 1, is produced in five operations performed consecutively on the dies *A*, *B*, *C*, *D*, and *E*, Figs. 2 and 3. The result of the work performed by each of these dies is shown by the five views in Fig. 1, each piece of work being identified by the same reference letter as the die on which it was produced. The shell was originally made by the metal spinning method from a blank 6 1/2 inches in diameter. A blank of the same size is used in drawing the shell, although a die-formed shell usually requires a larger blank than a shell of the same size produced by spinning.

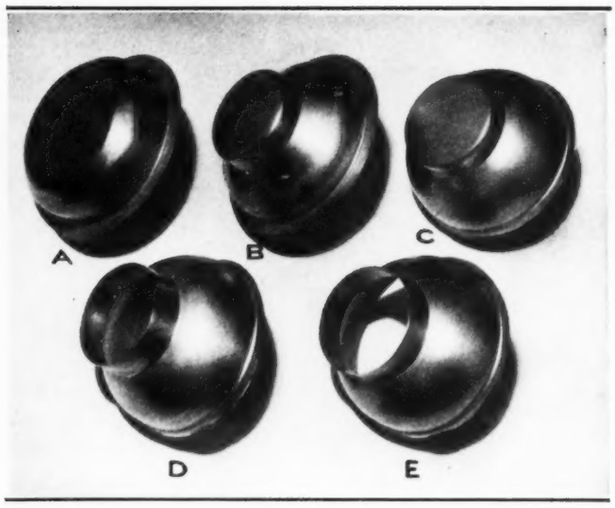


Fig. 1. Five Steps in the Production of a Spherical-shaped Shell from Flat Copper Stock

The small opening in the shell is tapered; that is, it is larger at the edge than at the point where it meets the spherical portion.

The shell is formed from 22-gage copper, 0.025 inch thick, and the first operation is performed on the die *A*, Fig. 2. This is a standard combination blanking and forming die having a hardened and ground punch, pressure ring, and cutting ring. The shell from this die, as shown at *A*, Fig. 1, has a body diameter of 4 5/16 inches and is drawn to a depth of 1 7/16 inches. The corners of the plug over which the metal is drawn are well rounded to avoid straining the metal.

The die used for the second operation is shown at *B*, Fig. 2. This die produces the upper part of the shell, forming the neck of the shell and lengthening the angular part preparatory to stretching it to the spherical shape. All parts of this die are of cold-rolled steel, the pressure ring and punch being pack-hardened. The corner of the pressure

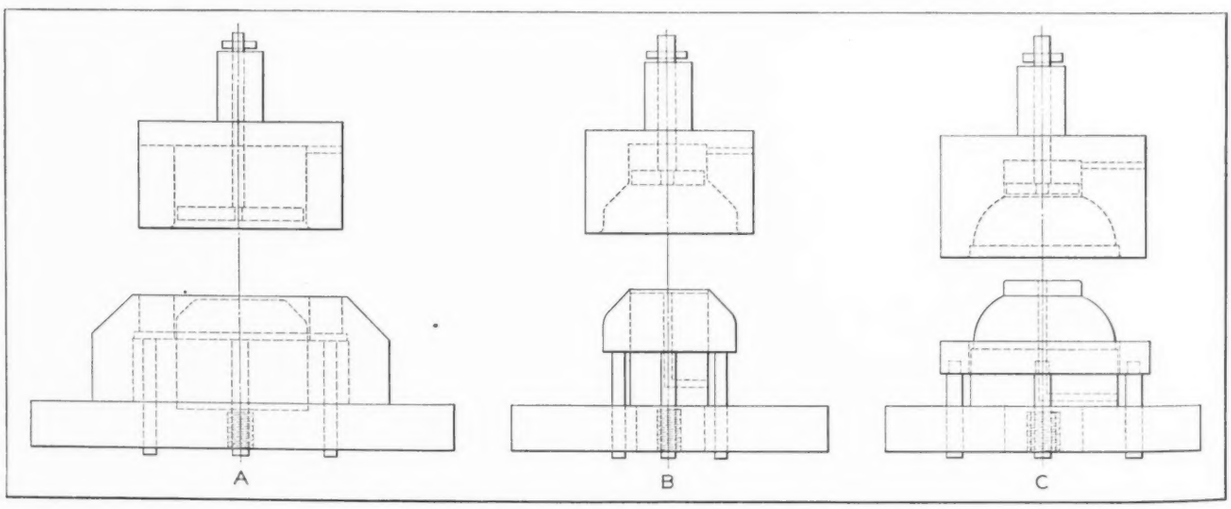


Fig. 2. Diagrams Showing Design of Dies Used Consecutively in Forming Shell to Shapes Seen at A, B, and C, Fig. 1

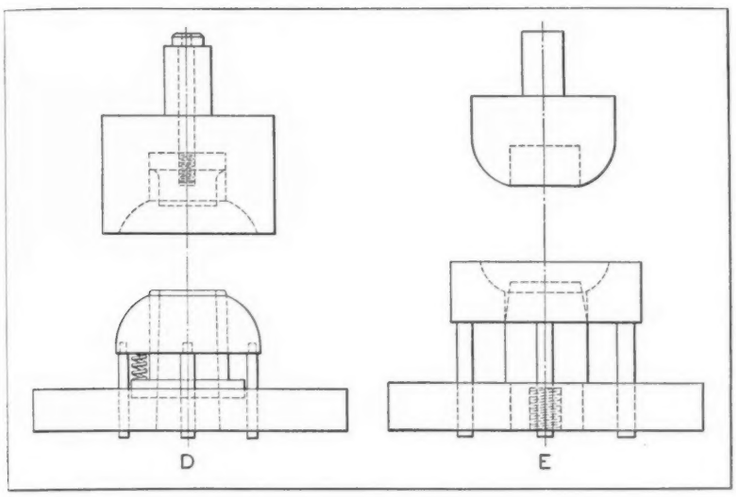


Fig. 3. Combination Piercing and Drawing Die, and Neck-tapering Die Used for Producing Work Shown at D and E, Fig. 1, Respectively

ring where the 45-degree angular portion meets the side was given a radius of 9/16 inch, as was the corresponding corner of the punch. This helped to eliminate drawing marks on the finished shell. The shell as it appears after this operation is shown at *B*, Fig. 1.

The third-operation die is shown at *C*, Fig. 2. All parts of this die, except the cast-iron baseplate and pressure pins, are of cold-rolled steel and are pack-hardened. It is more economical to make parts such as these from cold-rolled steel and pack-harden them, since, if properly done, there is practically no change in size or shape. This procedure made it possible to eliminate an expensive contour-grinding operation in this case. The shell is located on the die by the reduced neck portion, and the flange is held by pressure exerted by a "rubber spring barrel" while the body of the shell is being stretched to shape by the descending punch. The spherical portion of the shell and the small shoulder provided to facilitate accurate assembling are now finished, as shown in the view at *C*, Fig. 1.

The die shown at *D*, Fig. 3, is used for the next operation, which consists of punching out a blank 2 3/16 inches in diameter from the closed end of the shell.

Continued downward movement of the punch serves to straighten the remaining metal in such a way as to increase the height of the neck to 11/16 inch. The cutting die and punch are made of tool steel, hardened and ground, while the body of the punch and the pressure ring are of cold-rolled steel, which is left soft. Short springs are used to exert pressure on the ring, so as to strip the shell from the die.

Care must be taken to see that the punch takes a clean cut in operations of this kind, as otherwise slight cracks will appear on the edge of the opening after the metal is drawn from the horizontal into the vertical plane. This method of handling the work makes it possible to produce the spherical shell from a smaller blank than would otherwise be required. Thus a saving is made in the metal and a trimming operation is eliminated. The shell produced by this operation is shown at *D*, Fig. 1.

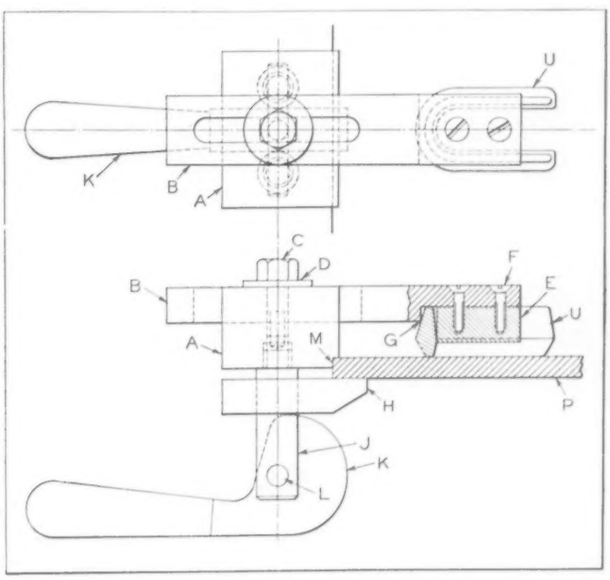
The remaining operation, consisting of tapering the neck opening, is performed on the die shown at *E*, Fig. 3. The center punch or plug on this die is made of tool steel, hardened and ground to a 3-degree taper at its upper end. The open end of the shell as it comes from the previous operation can be just started on the end of the plug, the body of the shell being supported by the pressure ring. This ring and the punch are of cold-rolled steel and are left unhardened, as they are not subjected to any appreciable wear. After this operation, the shell is trimmed at the large end and perforated. It is then ready for assembling as part of a cocktail shaker.

Adjustable Welding Fixture

By JOSEPH WAITKUS, Wellesville, N. Y.

The increased use of welding has created a demand for equipment designed to increase production and reduce costs, as well as to permit the welder to concentrate on welding and thus enable him to obtain more serviceable welds. The device here illustrated is a typical example of equipment developed to meet these requirements.

Large quantities of U-shaped members like the one shown at *U* were required to be welded to plates *P* of various thicknesses. The dimension from the edge of the plate to the bottom of member *U* was also variable. Hence, it was necessary to take measurements in locating each member *U* on the



Welding Fixture Used in Attaching Member U to Steel Plate P

steel plate. Additional measurements were also required for the subsequent positioning of the member for welding. Particular care was necessary in placing the U-shaped member so that its center line would be at right angles to the edge of the plate. All these factors combined to make the operation a tedious and expensive one.

The fixture shown in the illustration served to eliminate the principal difficulties and resulted in a more accurate and uniform product. This fixture consists primarily of a block *A* provided with a slot into which an adjustable bar *B* is fitted. A screw *C* and washer *D* serve to hold the bar in position in block *A;* the fillet piece *E* is fastened to the end of the bar by screws *F*. The fillet piece is, of course, made to conform to the internal shape of member *U*.

The end of bar *B* is cut away to provide an edge *G* which rests against the external surface of member *U*. Thus, member *U* is centralized at the end of bar *B* and is ready to be positioned on plate *P*. The clamp *H* is guided by two pins *J* fastened to block *A*. In operation, cam-lever *K* is pivoted on pin *L* between the pins *J*.

The clamping arrangement described can be applied to plates of various thicknesses. The edge *M* of block *A*, resting against the edge of the plate, assures the positioning of member *U* at right angles to the edge of the plate. The adjustable feature of bar *B* permits locating member *U* in various positions, as required.

Notching, Piercing, and Blanking Die

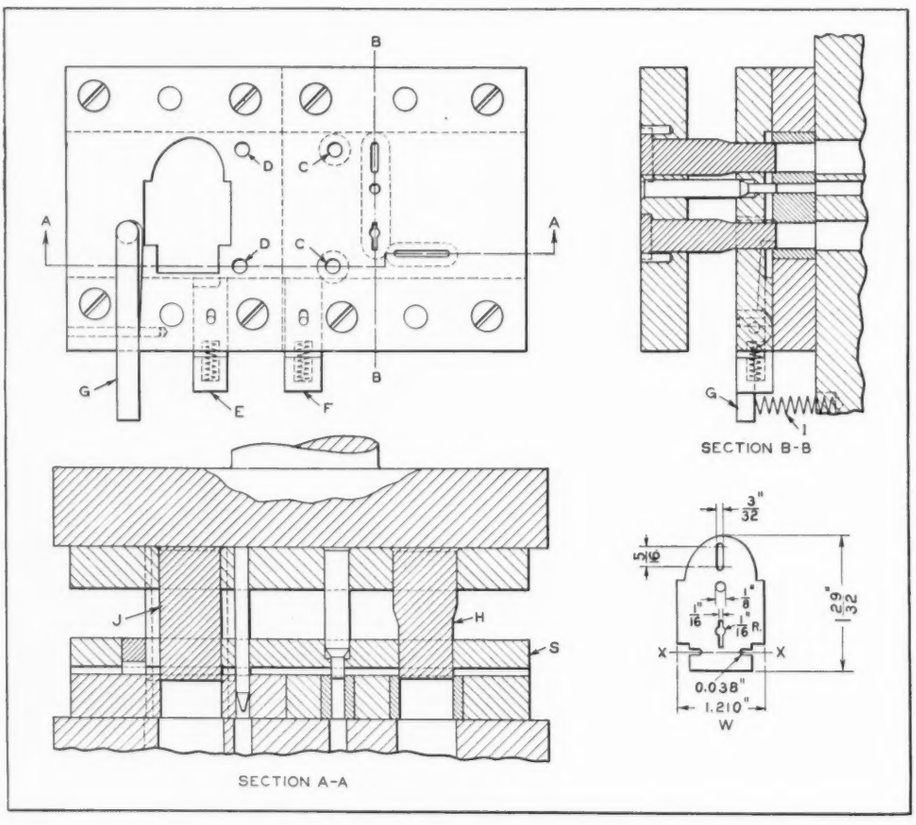
By JOHN J. McHENRY, Detroit, Mich.

The blank shown at *W* in the accompanying illustration is produced in moderate quantities and within reasonable limits of accuracy on the progressive type die shown in the illustration. Although the accuracy obtainable with a compound die was desirable in the production of the part, it was considered inadvisable to attempt to use a compound die because of the danger of breakage at the weak section *X–X*.

As will be noted in the upper view to the left, the die opening for the blank is machined to omit the necked section *X–X* of the blank, thus eliminating the weak factor. The notches in this section are made by the slotting punch *H* in a previous station. The two 3/16-inch holes pierced in the strip stock waste between the blanks at *C* and their corresponding pilots at *D* insure the desired accuracy. Aside from the features noted, the die is of the ordinary progressive type, with two finger-stops *E* and *F*, and a latch-stop *G*.

When the die is in operation, the strip stock is entered under the solid stripper *S* and pushed against the finger-stop *F*. The press is then tripped. Three holes are pierced by the punches located on section *B–B*, and two pilot holes *C* are pierced on the first stroke. The strip stock is then advanced to the second finger-stop *E* and the press tripped. On the down stroke, pilot-pins enter the pierced holes at *D*.

The strip stock is next advanced against the latch *G* with sufficient pressure to overcome the pressure exerted by the latch spring *I*, after which the press is tripped. The part pierced in the first down stroke of the press is blanked out by the punch *J*. A completed blank, as shown at *W*, is then produced at each succeeding stroke.



Progressive Notching, Piercing, and Blanking Die Designed to Eliminate Weak Die Construction at X–X

* * *

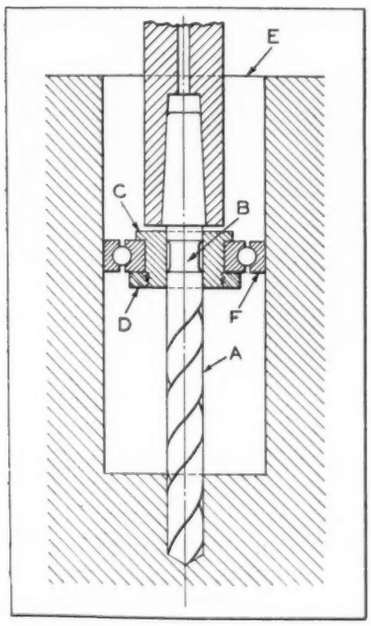
In the first decade after the annual automobile shows started, according to records of the Automobile Manufacturers Association, more than 600 new makes of passenger cars and trucks were entered for exhibition. In all, the industry has produced more than 1800 different brands or makes of automotive vehicles.

Ideas for the Shop and Drafting-Room

Time- and Labor-Saving Devices and Methods that Have been Found Useful by Men Engaged in Machine Design and Shop Work

Jig for Centering Drill at Bottom of Deep Hole

In salvaging 150 hydraulic cylinders recently, it was necessary to drill a 3/4-inch hole at the approximate center of a bored hole 3.515 inches in diameter. The jig used to guide the drill in the center of the bored hole consists of a No. 6210 S K F ball bearing *F*, a collar *C*, and a nut *D*, arranged as shown in the illustration.



Ball Bearing Used as Drill-centering Jig in Deep Hole

The lower portion of the taper shank of a standard 3/4-inch high-speed drill *A*, was ground down to a diameter of 3/4 inch so as to provide a shoulder for the collar or bushing *C*. The collar *C* is threaded at its lower end to receive the nut *D*, which clamps the inner race of the ball bearing to the collar. The outer race of the ball bearing is ground down from 3.5433 to 3.510 inches to obtain a good slip fit in the bored hole *E*. Collar *C* was made a press fit on the drill and on the inside of the ball bearing.

LaSalle, Ill. K. N. BANTHIN

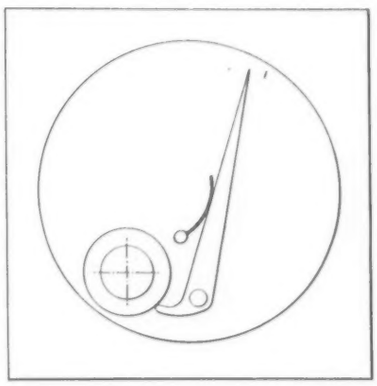
Cleaning Triangles and T-Squares

The dirt and grime that sometimes accumulates on T-squares, triangles, slide-rules, and scales can be readily removed through the aid of ordinary floor wax. The wax should be applied with a clean rag. After all the dirt has been removed, the article is allowed to stand about five minutes until the wax has hardened. It should then be rubbed briskly with a soft, clean cloth. This treatment produces a lustrous, smooth finish.

Los Angeles, Calif. JOSEPH W. GASPER

Gage for Testing Concentricity of Bushings

A simple limit gage for testing the concentricity of turned and drilled bushings is shown in the accompanying illustration. The gage consists primarily of a baseplate, an indicating needle fitted on a pivot, and a plug on which the bushing can be mounted for testing. A small spring holds the point of the needle against the bushing while it is being turned on the plug. F. H.



Gage for Testing Concentricity of Hole in Drilled Bushing Previous to Hardening and Grinding

* * *

General Electric Honors Employes with Long Service Records

The General Electric Co., Schenectady, N. Y., has just completed its sixtieth year of corporate existence. It was in 1877 that Thomas A. Edison founded the business that became the nucleus from which the present General Electric Co. has grown. In commemorating the event, the Chamber of Commerce at Schenectady gave a dinner at which three veteran employes of the General Electric Co., with fifty or more years of active service, were presented by the company with engrossed certificates and diamond-studded pins. These employes were Charles J. Leephart of Schenectady, N. Y., with fifty-five years of service; Roderick S. McNeil of Bridgeport, Conn., with fifty-one years; and George S. Jameson of Lynn, Mass., with fifty years.

* * *

In 1903, Mr. Carnegie bought a Winton automobile. Shortly afterward, he wrote to Mr. Winton as follows: "We are greatly pleased with our new Winton. From the very start it has done its work and never failed us. There may be improvements yet to come, even in such autos, but it is difficult to see much room for them."

Questions and Answers

A Department in which the Readers of MACHINERY are Given an Opportunity to Exchange Information on Questions Pertaining to the Machine Industries

Can Die-Castings be Welded?

F. S.—Please inform me if there is a method by which die-castings can be welded.

A.—One of the leading manufacturers of electric welding equipment states that electric welding of die-castings is impracticable because of the low melting points of die-casting alloys, especially zinc alloys which are more widely used for die-castings than any other metal. A well-known manufacturer of oxy-acetylen welding equipment gives practically the same advice. It is said that, although the welding of die-castings is possible, it requires unusual skill, on account of the fact that the die-cast metal melts at a low temperature.

A Question on the Legality of a Patent

R. M. C.—Manufacturer A made improvements in an article in 1929 and immediately placed it on the market. In 1931 and 1932, he made arrangements with company B to manufacture the improved article. In 1934, manufacturer A applied for a patent, which was issued in June, 1936. Company B now insists that it has the right to manufacture the improved articles despite manufacturer A's patent, on the ground that B not only manufactured these articles prior to the issuance of the patent, but also because A did not secure a patent until fully seven years after the articles had been placed on the market. Can B manufacture these articles now, independently of A?

Answered by Leo T. Parker, Attorney-at-Law
Cincinnati, Ohio

When an inventor files an application for a patent, he must swear that the device, to the best of his knowledge, has not been on the market for sale, nor been described in a publication, at any time more than two years prior to the time the application was filed. Therefore, under ordinary circumstances, the patent referred to is void, because it was on the market for five years before the application was filed.

However, in one case, the Court held that an inventor may make use of his invention for the purpose of experimentation without regard to the time the application is filed. In this case, an inventor laid a pavement and it was in public use for six years before he filed an application for a patent; but the use was purely experimental, and the pavement was not sold or offered for sale, nor was it described in a publication. Therefore, the Court held that this use did not invalidate the patent which the inventor obtained eight years after the pavement was first laid and used publicly. On the other hand, if he had sold this pavement, or had used it for any reason other than for the purpose of testing its durability, to determine whether its value was of sufficient importance to justify filing an application for a patent, then the patent would have been held void.

Now, another important point of the law is as follows: Assume that a manufacturer contracts to pay an inventor a royalty on a device that is not patented. Later, the inventor files an application for a patent and finds that he cannot obtain a patent. Notwithstanding this situation, the manufacturer who contracted to pay the royalty is bound to continue the payments unless it was specifically stated in the contract that the manufacturer could discontinue payment of the royalties in the event that the inventor found he was not able to obtain a valid patent.

* * *

The Automobile Industry in 1938

According to figures compiled by the Automobile Manufacturers Association, during the year ending September, 1938, the manufacturers in the United States and Canada sold 2,704,992 cars and trucks, of which 2,130,214 were passenger cars and 574,778 trucks. The wholesale value of the passenger cars was $1,310,000,000, and of the trucks, $373,600,000. In addition, the wholesale value of parts, accessories, tires for replacement, and service equipment amounted to $950,285,000.

At the end of September, 1938, there were 24,600,000 passenger cars and 4,200,000 trucks registered in this country, a total of 28,800,000. The total registration for the entire world was 41,500,000. In other words, nearly 70 per cent of all the automobiles and trucks in the world were used in this country. The number of American motor vehicles sold outside of the United States amounted to 538,500.

The users of motor vehicles paid in direct taxes on their cars $1,585,000,000, not counting gasoline taxes. Gasoline taxes—federal, state, and municipal—amounted to $975,000,000.

In the automobile, body, and parts factories, 337,000 people found employment. Their weekly payroll amounted to $9,200,000. The value of the gasoline used by motor vehicles—retail cost, including taxes—reached a total of $3,840,000,000.

The Question of Reciprocal Buying

By J. F. LINCOLN, President
Lincoln Electric Co., Cleveland, Ohio

Under the attack on business by the present Administration, we manufacturers like to feel that we are martyrs. We know the attack is unjustified, in general. Government, however, has uncovered some abuses which are real enough to justify action in some cases. One of these abuses, which has not yet been the subject of regulation, but which will and perhaps should be, is that of reciprocal buying. This exploded theory is continued only because of its age—not because anyone in industry finds it a satisfactory method of placing business.

Industry, at great expense, sets up a purchasing department, an inspection department, and an engineering department to produce material of proper price and quality. After having done this, a reciprocal relations department is put in that overrides the decisions of the buyer, the inspector, and the engineer, and places business on the basis of reciprocity, resulting in frequently strained industrial relations, since no one can buy in a volume to satisfy the reciprocator. Not only that, but the distribution is never fair from the seller's point of view.

Reciprocal buying results in higher prices, since the reciprocator cannot get the best price available. It results in lower quality, since the reciprocator cannot insist on quality. It results in lack of standardization, which enormously increases the cost of upkeep.

I can see the joy with which some politicians, and even members of the Administration, will pounce on this industrial foible to show how incompetent is the management of American business. With that proof, the New Deal can show that it is necessary for Government to guide, direct, and protect industry, and thus only can it be kept solvent. As a matter of fact, who can show that Government is not right in such conclusions? Result: One law, a million new jobs, and a billion new taxes.

The worst of it is that, in this instance, the Government would have a perfectly clear case to prove its point. No one could take the untenable position that reciprocal buying is anything but foolish and wasteful. However, in the hands of governmental regulation for its elimination, a waste will be turned into regimentation from which industry perhaps can never recover.

* * *

A New Fluorescent Electric Lamp for Industrial Use

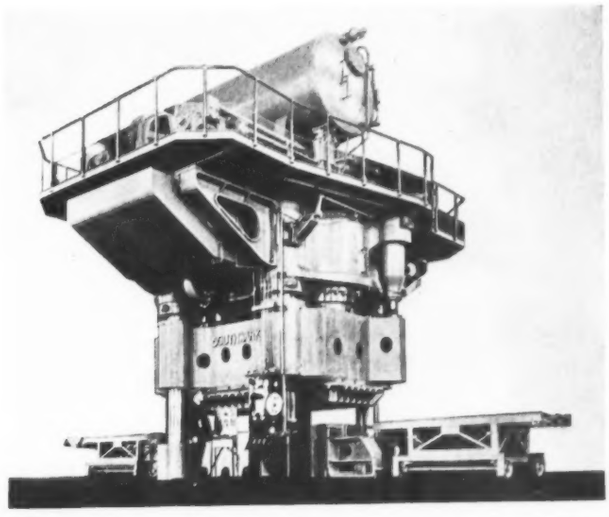
A new light source for general industrial lighting—a 100-watt fluorescent lamp—has been developed by the General Electric Vapor Lamp Co. to supplement its line of industrial lighting units. The new lamp is tubular and is 4 feet in effective length. It derives the name "fluorescent" from the utilization of a high efficiency fluorescent material as the inside coating of the tube. Ultra violet radiations produced in the tube are converted by this coating to visible light. The rated life of the new light source will compare favorably with that of other industrial lamps.

Probably the most outstanding feature of these new lamps is their high efficiency, which is three times that of equivalent incandescent lamps.

* * *

A recent study of eight large manufacturing plants in Toledo, Ohio, shows that last year these companies paid $258 in taxes of all kinds for each worker employed. The same companies spent $79 for each worker employed on the development of new products to provide more jobs. Had there been less taxes, still more could have been spent for development work.

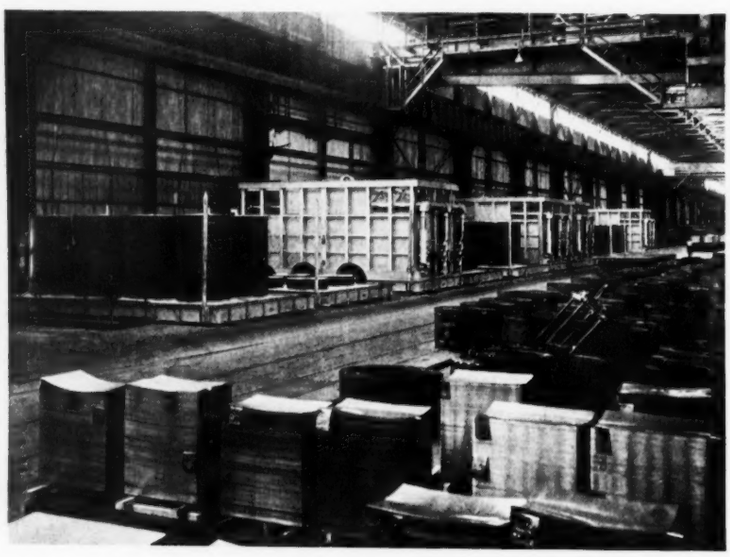
A 5500-ton Capacity Hydraulic Press which is One of Three Built by the Southwark Division of the Baldwin-Southwark Corporation, Eddystone, Pa., for Forming Duralumin Aircraft Parts. The Press Stands 33 Feet High and Weighs Approximately 960,000 Pounds. The Press Platens—Huge Single Steel Castings—Weigh 160,000 Pounds Each. A Total of 400 Horsepower of Electric Motors is Required to Operate the Pumps of the Press. The Complete Shipment of the Three Presses Required the Use of Forty-two Railroad Cars



Opening of New $60,000,000 Mill

Continuous 80-inch Hot Strip Mill at the New Irvin Works of the Carnegie-Illinois Steel Corporation

ONE of the largest industrial plants in the world ever conceived and built as a single unit has just been completed in the Pittsburgh district by the Carnegie-Illinois Steel Corporation, a subsidiary of the United States Steel Corporation. This mill may well be said to be the last word in continuous strip mill development.



The Tin Annealing Department at the Irvin Works

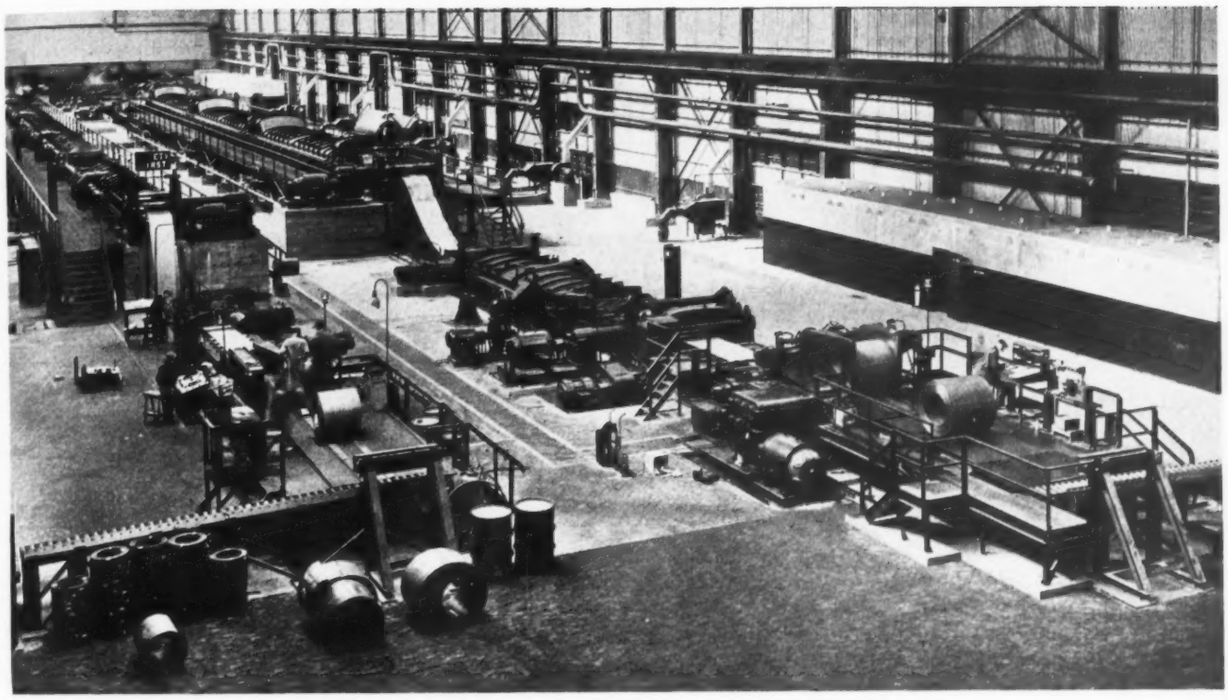
The Irvin Works, as the new plant is called, consists of the following principal units: An 80-inch hot strip mill, ten-stand tandem; an 84-inch cold reduction mill for sheets, three-stand tandem; a 54-inch cold reduction mill for sheets, single reversing; a 42-inch cold reduction mill for tin plate, five-stand tandem; and a tin house with fourteen tinning stacks. In addition, there are, of course, the required finishing departments. The mill has an annual capacity of 600,000 tons of hot strip—500,000 tons of sheet steel, and 100,000 tons of tin plate.

This new mill is electrically operated throughout. All together, there are 2000 motors, with a total of 300,000 horsepower. The three largest motors are of 10,000 horsepower each.

The building and equipping of the new plant involved an investment of approximately $60,000,000. When running to capacity, it will employ close to 4000 people. The site for the Irvin Works was literally carved out of the hills. The entire site is 650 acres, of which over 300 had to be leveled by moving more than 4,000,000 cubic yards of earth.

On this site, seventeen main buildings have been erected, the area under roof being 51 1/2 acres. The over-all length

Shows Faith in the Future



General View of Continuous Raw Coil Picklers, Showing the 36-inch Pickler to the Left, and the 80-inch to the Right

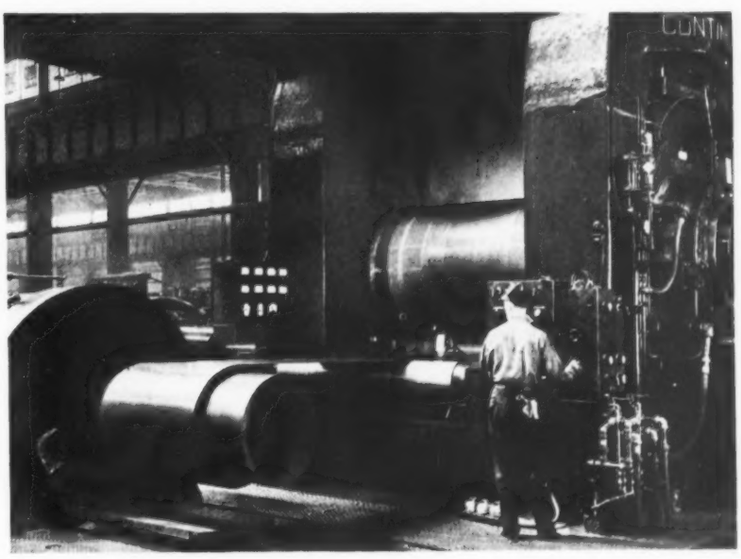
of the built-up area is 4275 feet, and the width 1230 feet. The buildings are served by fifty overhead cranes of from 5- to 60-ton capacity.

Dealing now in somewhat greater detail with each of the main departments, one first notes the hot strip mill motor house which contains, in addition to the generating and electrical operating equipment, twelve giant motors for the operation of the scale-breakers and roughing and finishing stands of the 80-inch continuous hot strip mill.

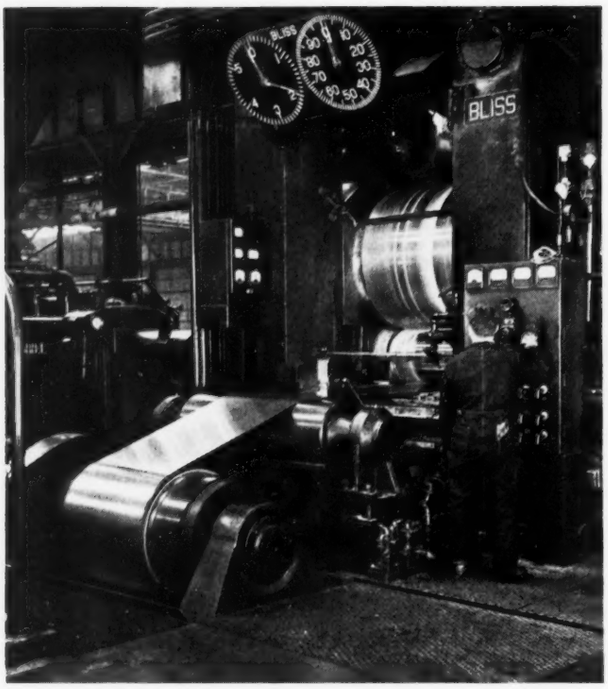
There are three slab-heating furnaces serving the hot strip mill. Into these furnaces, each separately regulated and controlled, the cold slabs are charged to bring them to the correct rolling temperature. As one cold slab is charged, another, at the discharge end, heated to the right temperature, drops on the roller table, ready to start through the mill.

The 80-inch continuous hot strip mill consists of four 4-high roughing stands, six 4-high finishing stands, and a full complement of scale-breakers, end-crop-shears, and edging rolls, together with a flying shear situated just beyond the last stand of the finishing train. When the strip of hot steel leaves the last stand of the hot mill, its speed is often as high as 2000 feet per minute.

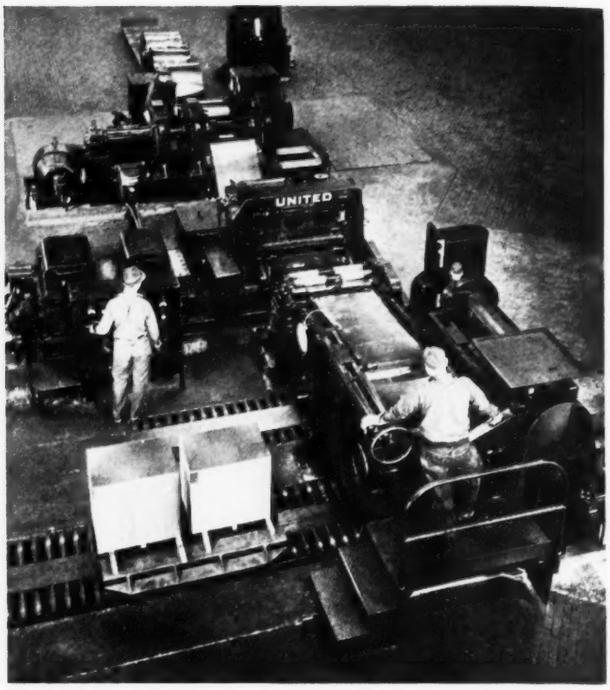
The strip may be cut into flat lengths by the flying shear or may be wound into coils in the coiling pit, according to whether the finished product of the hot mill is to be finished in sheet or coil form. All of these operations are wholly automatic. The coiling pit is situated some 400 feet from the last finishing mill and under the main run-out table.



Tension Reel on 84-inch Three-stand Tandem Cold Reduction Mill



Delivery End of a 54-inch Reversing Mill in the Cold Reduction Department



One of the Tin Shear Lines. The Maximum Speed of This Line is 350 Feet per Minute

In the coiling pit, there are two coilers. Traveling through guides, the steel is coiled, the coils ejected, tied and placed on an endless conveyor which transports them to the raw coil storage. Cut sheets travel the full length of the main run-out table, approximately 700 feet from the last finishing stand. They are automatically piled and then moved to storage by the cranes.

From this point on, coils or sheets may be further finished by a combination of processes. The hot strip finishing equipment consists of shears, shear lines, temper mills, scrubbing lines, and a sheet-pickler. When the steel is to be cold-reduced, it passes through one of two continuous picklers and is delivered to one of the three cold mills, all of which are four-high. One of these cold mills consists of five stands in tandem for tin mill products, one of three stands in tandem for sheet products, and one of a single stand of the reversing type for both sheet and tin products.

After cold-reduction, the product may be processed in one or more of the finishing operations, passing through shearing lines, sheet-mill annealing, normalizing furnaces, temper mills, and roller levelers, to final inspection.

The cold-reduced strip to be finished into cold-reduced tin or black plate products is passed through the electrolytic cleaning lines and made ready for tin mill annealing. After this processing, the steel is temper-rolled and sheared. From this point on, according to the nature of the finished product, the steel may be shipped as black plate. or it may be white pickled, tinned, and cut into assorted sheets before packing and shipping.

The Irvin Works was named in honor of William A. Irvin, who is vice-chairman of the board of directors of the United States Steel Corporation. This brief description would hardly be complete without reference to the steps by which Mr. Irvin came to occupy his position in the United States Steel Corporation.

Mr. Irvin was born in Indiana, Pa., in 1873. At the age of eleven, he started to work for the Western Union as a messenger. Two years later, at the age of thirteen, he got a job as telegraph operator in his home town station of the Pennsylvania Railroad. Later, he was transferred to Apollo, Pa. Here were located the steel works of P. H. Laufmann Co., Ltd., and of the Apollo Iron & Steel Co. The young man got a job with the former company as chief clerk in the shipping department.

In 1900, when the American Sheet Steel Co. was organized and absorbed the P. H. Laufmann Co., Mr. Irvin became chief of the cost department. In 1904, when this company was merged with the American Tin Plate Co. to form the American Sheet & Tin Plate Co., he became chief clerk of the operating departments of the new company, and in 1909 he was appointed assistant to the vice-president. Sixteen years later, in 1925, he became vice-president in charge of plant operations.

In 1931, he became vice-president in charge of manufacturing operations of the United States Steel Corporation; in 1932, he was elected president of the corporation; and in 1937, he became vice-chairman of the board of directors.

* * *

Automobile tire mileage has increased 76 per cent in the last ten years, according to studies made by the Rubber Manufacturers Association.

Simplified Method of Using Logarithms Having Negative Characteristics

By ERNST HIMMELSBACH
Dominion Engineering Works, Ltd., Montreal, Canada

The writer has found that addition, subtraction, multiplication, and division of logarithms having negative characteristics are greatly simplified by using the method outlined in this article. The fundamental principle of this method is not new; in fact, it has been in use for many years, but is not as well understood as it might be. It is based on adding any convenient number to the characteristic and subtracting it separately, as indicated in the following:

$$\begin{aligned} \log 2 &= 0.30103 \\ &= 10.30103 - 10 \\ &= 12.30103 - 12 \\ \text{also } \log 1938 &= 3.28735 \\ &= 13.28735 - 10 \\ &= 14.28735 - 11 \\ \text{and } \log 0.003 &= \overline{3}.47712 \\ &= 7.47712 - 10 \\ &= 9.47712 - 12 \end{aligned}$$

Example of Adding Logarithms:

$$\begin{array}{r} 3.42420 - 10 \\ 2.19047 \\ 9.49123 - 10 \\ 0.44398 \\ 7.45680 - 10 \\ \hline 23.00668 - 30 = 3.00668 - 10 \\ = \overline{7}.00668 \end{array}$$

The writer never uses the form $\overline{7}.00668$, as it has been found confusing and a source of error. preferring the form 3.00668 — 10.

Subtracting Logarithms:

$$\begin{array}{rr} & 18.57628 - 20 \\ (-) & 17.04713 - 20 \\ \hline & 1.52915 - 00 \end{array}$$

also

$$\begin{array}{rr} & 18.27910 - 20 \\ (-) & 13.09656 - 10 \\ \hline & 5.18254 - 10 \end{array}$$

How combined additions and subtractions are carried out will readily suggest itself.

Taking now the problem given on page 124 of the Ninth Edition of MACHINERY'S HANDBOOK:

Find the value of 0.31^5

$$\begin{aligned} \log 0.31 &= 9.49136 - 10 \\ \log 0.31^5 &= (9.49136 - 10) \times 5 = 47.45680 - 50 \\ &= 7.45680 - 10 \\ &= \overline{3}.45680 \end{aligned}$$

Incidentally, the problem of finding the negative value of a logarithm (see page 123 of HANDBOOK) can be solved thus:

$$\begin{array}{rr} (-\log 950) = & 10.00000 - 10 \\ (-) & 2.97772 \\ \hline & 7.02228 - 10 \\ = & \overline{3}.02228 \end{array}$$

also

$$\begin{array}{rr} (-\log 0.003) = & 10.00000 - 10 \\ (-) & 7.47712 - 10 \\ \hline & 2.52288 \end{array}$$

Extracting Roots by Logarithms: See Example 2, page 124, MACHINERY'S HANDBOOK.

Find $\sqrt[3]{0.67}$

$$\begin{aligned} \log 0.67 &= 9.82607 - 10 \\ &= 29.82607 - 30 \\ (29.82607 - 30) \div 3 &= 9.94202 - 10 \\ &= \overline{1}.94202 \end{aligned}$$

which is the logarithm of the required value.

The writer has found this method much simpler than it might seem to be from the somewhat lengthy description.

* * *

There is Still Room for Men of Ability

As chief executive of a manufacturing company, in which welding plays a prominent part, the most difficult problem I have to face in our shop is to find men who can be developed into leaders. This is so because too few young men are willing to put forth the effort necessary to win advancement. Just to be a good welder will not assure advancement. One must show his employer that he possesses a knowledge of his art superior to the average, and that he has the ability to put that knowledge to effective use, if he is to be given added responsibility and obtain the material rewards that go with it. One cannot attain advancement without study, and study must be done outside of regular working hours.—*A. E. Gibson, President, Wellman Engineering Co., Cleveland, Ohio, in the Lincoln "Welder's Stabilizer."*

* * *

Employment in the Automobile Industry

In considering the effect of the automobile industry on employment, we are concerned not only with the actual automobile and parts factories, which, during the year ended September, 1938, employed on an average of 337,000 people, but also with the number of people employed in selling and servicing automotive equipment. There are, in the United States, nearly 44,000 car and truck dealers, 92,600 repair shops, and 95,500 separate retail outlets. There are also about 380,000 gasoline stations. It is evident, that these sales agencies, shops, retailers, and gasoline stations employ, in total, a great many more people than the automobile factories themselves.

All-Welded Locomotive

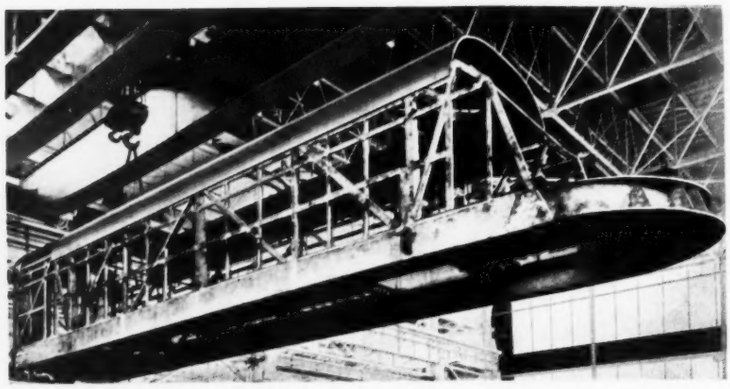


Fig. 1. An All-welded Locomotive Frame Lifted by a 200-ton All-welded Crane in an All-welded Factory Building

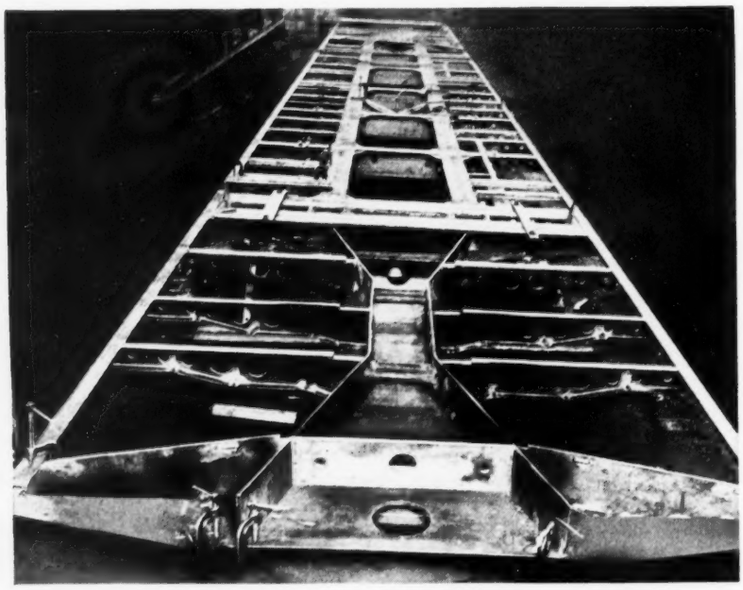


Fig. 2. Welded Under Frame of a Modern Diesel-electric Locomotive

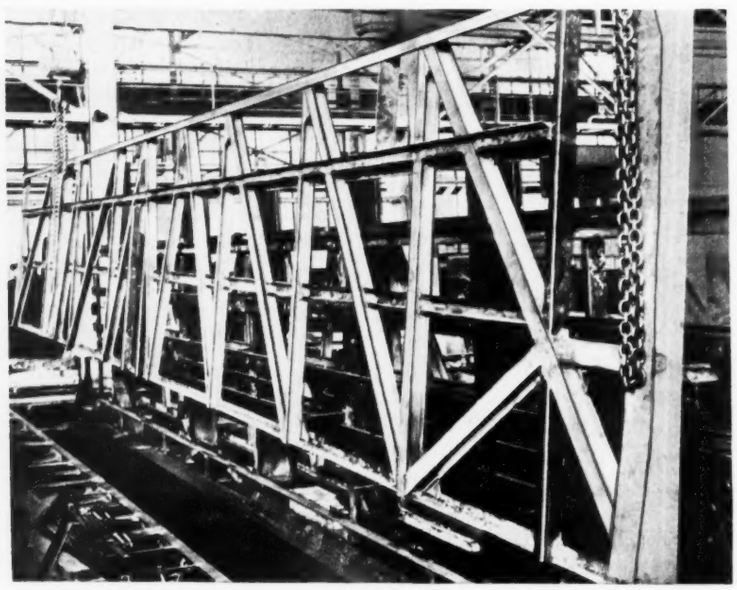


Fig. 3. Locomotive Side Frame after Welding

IN a paper that received the second main award of over $2500 in the railroad group of the competition sponsored by the James F. Lincoln Arc Welding Foundation, John H. Hruska, metallurgical engineer of the Electro-Motive Corporation, LaGrange, Ill., outlines the procedure followed in completely welding the bodies of Diesel-electric locomotives. Since the epoch-making trip of the first three-car Zephyr train from Denver, Colo., to Chicago, during the Century of Progress Exposition in 1933, an almost complete change has taken place in high-speed Diesel-electric locomotives. Riveting and bolting have been supplanted almost entirely by all-welded assemblies—at least where ferrous metals are used in the construction. Many advantages are claimed for the new method, including uniform stress distribution in the body, decreased cost of production, neater appearance, and easier cleaning and painting.

The base or under frame of the locomotive—probably the most complicated part of the structure—consists of a series of specially designed beams welded to two long Z-bars, as indicated in Fig. 2. Rather simple fixtures for locating the parts in assembling the base structure are used. All the work is carried out on six welding supports, permitting easy access to all parts above and below the fabricated base.

The side frames are similarly welded together on carefully proportioned fixtures, allowance being made for shrinkage to the finished dimensions. The importance of this consideration will become apparent from Fig. 3, which shows the locomotive side frame just after the welding is completed.

The transverse strains that would tend to cause deformation by the static loading of the under and side frames are mainly taken up by the welded roof. After the two side frames and the roof have been completed, the actual assembly begins. First one side frame is removed from the welding jig and welded in an upright position to the base frame; then the other side is welded to the base. Careful positioning is maintained by tie-rods tacked by weld-

Diesel-Electric Frames

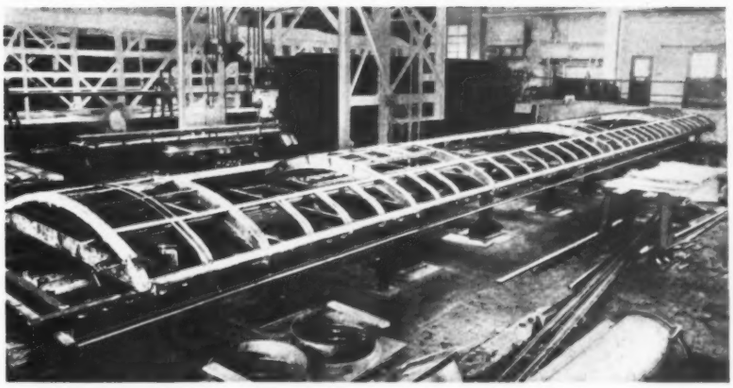


Fig. 4. Welded Roof of the Diesel-electric Locomotive Shown in Place on the Welding Jig

ing to the frames. While all the tie-rods remain in position, the roof is welded in place. After adding the end sheets and additional cross-rods, gussets, etc., the tie-rods are removed, and brackets, pipe clamps, fan frames, and similar parts are welded in place.

In the meantime, fuel tanks, water tanks, sand boxes, and battery boxes are being manufactured by arc welding and tested for possible leakage. These are then welded to the frame, thus practically completing its fabrication. The hatches are also being finished by welding at this time. They are applied after the power plant, wiring, and piping are in place.

* * *

Machinery Industry in Switzerland

According to statistics published by the Industrial Machinery Division of the Bureau of Foreign and Domestic Commerce, Washington, D. C., at the end of 1937 there were 158 machinery manufacturers in Switzerland who were members of the Association of Swiss Machine and Metal Manufacturers. Close to 60,000 people were employed in the industry. This is an increase of 14,000 over 1936, but still not quite equal to the employment in the industry in 1929.

Tri-Cities Chapter of the American Society of Tool Engineers

The twenty-third chapter of the American Society of Tool Engineers was organized December 2 at the Fort Armstrong Hotel, Rock Island, Ill. The new chapter is to be known as the Tri-Cities Chapter and will include the industrial district surrounding the cities of Moline, East Moline, and Rock Island, Ill., and Davenport, Iowa. Fifty-five charter members were present at the organization meeting. Otto R. Reller, production manager of the Moline Tool Co., was elected chairman; Joseph B. Morganthall, chief tool designer of the John Deere Wagon Works, vice-chairman; Kenneth C. Jasper, tool designer at the Rock Island Arsenal, secretary; and W. Z. Fidler, chief draftsman of the Reynolds Engineering Co., Rock Island, Ill., treasurer. The American Society of Tool Engineers now has a total membership of approximately 3000.

A Cast-iron Roll 5 Feet in Diameter and 18 Feet Long, Rough-turned, Faced, and Bored with Haynes Stellite "2400" Tools. Two Tools are Used for Rough-turning, the First Taking a 1/4-inch Cut, and the Second a 1/8-inch Cut, at a Surface Speed of 85 Feet per Minute and a Feed of 1/4 Inch per Revolution. The Rough-turning Tools Travel a Distance of Approximately 13,500 Feet, or 2 1/2 Miles, along the Surface of Each Roll. Two Complete Rolls are Turned for Each Grinding of the Tools

A Machine Shop on Wheels

Fig. 1. Mobile Machine Shop Built by the Couse Laboratories, East Orange, N. J.

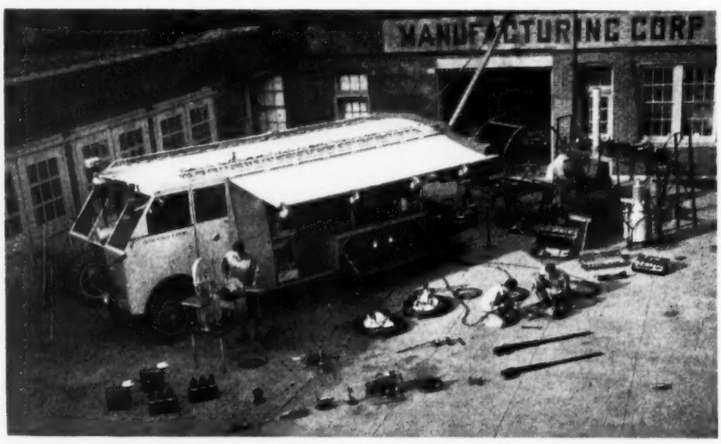


Fig. 2. The Mobile Machine Shop in Action

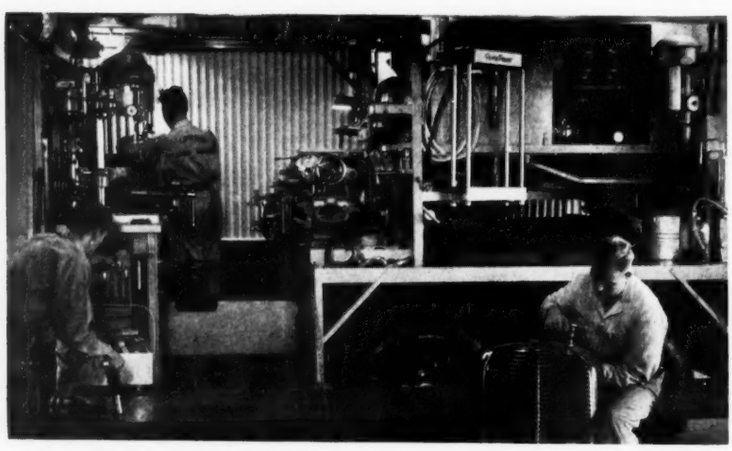


Fig. 3. Interior View of the Machine Shop on Wheels, Showing Some of the Machine Tools with which it is Equipped

THE increase in the size and number of airplanes, as well as in the complexity of the equipment required by present-day mechanized armies, have forced the development of field repair facilities of the mobile type to supplement or replace the usual stationary machine shops. To meet the demand for such mobile machine shops, the Couse Laboratories, Inc., East Orange, N. J., have developed what may well be termed a "machine shop on wheels." These machine shops, one of which is shown in the accompanying illustrations, are not only portable shops, but are complete repair stations, equipped with radio receiving and transmitting sets for communication with planes or headquarters, an office for the man in charge, with correspondence files and desk, convertible sleeping bunks, and a stove to keep the interior warm in winter weather.

Obviously, it is vital that this mobile shop be able to reach the place where emergency work is to be done despite bad roads, mountain grades, etc., as, for example, when a call for help is received from an airplane that has been injured in making a forced landing. This requires a much more rigid construction than is available in the conventional truck chassis and van type body. Also, the usual construction is too flexible to be suited as a base for machine tools. Hence, the body is constructed so that it acts as a chassis; the machine tools are built in, and the very rigid all-welded unit is "floated" by a three-point suspension on three axles.

The machine tool equipment of these mobile shops is especially selected and adapted to the requirements of field work, where the range of jobs encountered is extremely wide. Each machine has its attachments grouped with it. Small tools, such as twist drills, taps, etc., are all mounted on blocks in plain sight, so that a quick inventory of them can be taken—an important point in outdoor work.

Most of the shop work is done from the ground level at the heavy steel-plate work-bench located at the rear of the unit. At the right side of this plate and within range of the radial drill arm is a universally mounted vise adapted to hold the many-angled fittings encoun-

tered in airplane work. The lathe has a 15-inch swing and a 6-foot bed. It can be rapidly converted into a milling machine suited to the type of jobs encountered in repair work. A dividing head with standard index-plates for spline and gear cutting is part of the milling equipment.

The electrical system is an integral part of the unit, and can be operated as a power plant when current is not available. When commercial power lines are available, the unit can be plugged in and operated without running the gasoline engine. In military service and when the unit is maintained at an independent airport or repair station, the normal crew is ten men.

* * *

Labor Union Official Gives the Remedy for Unemployment

Our experience during the last five years has proved conclusively that government spending can only supply temporary relief. The spending of vast sums in relief payments, no matter how necessary they may be, will not restore to the workers their jobs. As the executive council of the American Federation of Labor has well stated: "The real remedy for unemployment is the creation and maintenance of work opportunities for men and women in private industry."

How can this best be accomplished? The first and immediate step should be toward the restoration of public confidence in private industry, at the same time creating cooperation and understanding between those who own and manage industry, labor, and the Government.—*Matthew Woll, Vice-president, American Federation of Labor, in the "Greenwich Time."*

* * *

$168,000 Gone Because . . .

In August, 1937, we went through a manufacturer's plant; everything in fine shape. He handed us his financial statement, prepared by outside auditors; owed nobody, was discounting, had a cash surplus of $168,000. A few days ago, to our astonishment, a large creditor asked us to investigate this firm's condition. Found the $168,000 gone; found $79,000 of past-due indebtedness; found chaos in the business. What had happened? Labor trouble, fostered by the great Wagner Act.

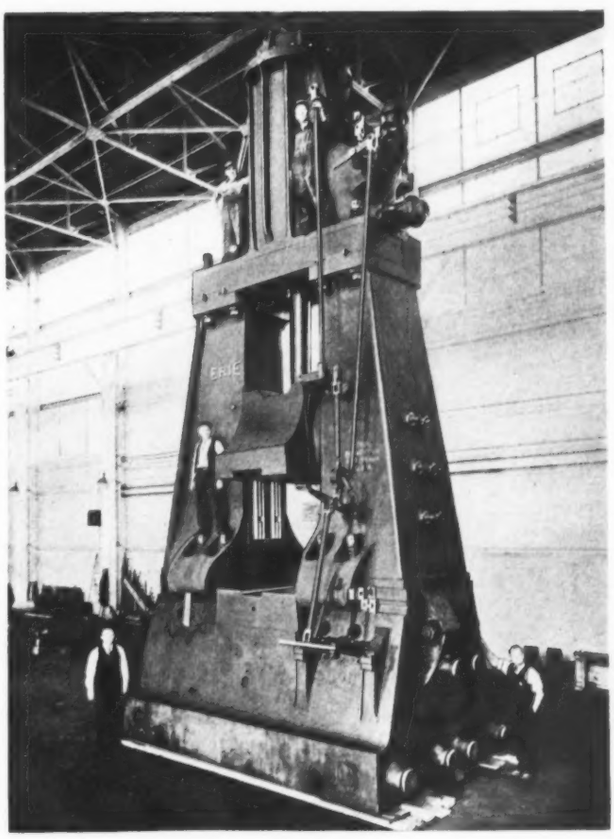
For years this concern had an honorable record of dealing fairly with its employes. We are organizing the creditors to help this concern because it needs help, but it looks like a certain failure.

In our opinion, the National Labor Relations Board, operating under the Wagner Act, is one of the two main causes of the present depression. Financial statements, past honorable business records, are going before the wind under the Wagner Act.—*Merritt Fields, Executive Manager, Indianapolis Association of Credit Men, in the Bulletin of the Employing Printers' Association of America.*

Giant Erie Steam Hammer Shipped to England

What is believed to be the largest steam drop-hammer ever built was recently completed by the Erie Foundry Co., Erie, Pa., for the forging of airplane propellers and airplane engine crankcases for British aircraft. This huge machine, which is being shipped to England, will, after installation, have a height from the floor line to the top of the cylinder of 27 feet. Beneath the floor it extends nearly 13 feet into the ground, where it rests upon a foundation anchored to bedrock. The sub-anvil structure beneath the floor is made in two pieces, each of which weighs approximately 234,000 pounds. The super-anvil, which is above the floor line and supports the frames, is also made in two pieces, which weigh approximately 200,000 pounds each.

The weight of the ram, piston-rod, and piston is 50,000 pounds, and with the top die included, the reciprocating weight is over 70,000 pounds. The diameter of the cylinder is 39 inches and the piston stroke 72 inches. The piston-rod diameter is 11 1/2 inches. The space between the guides is 4 feet 2 inches, and the size of the ram, front to back, is 6 feet 8 inches. The total weight of the hammer is about 500 tons. In spite of the size of the hammer, the control is so sensitive that the ram can be stopped within a small fraction of an inch.



Erie Steam Hammer Weighing 500 Tons, which has just been Shipped to England

Chrysler Develops a Fluid Drive for Automobiles

An entirely new method of transmitting power from the engine to the transmission of an automobile was recently demonstrated to members of the press in New York City by the Chrysler Corporation. This method involves the use of a fluid coupling that is substituted for the regular flywheel. Through the application of this unit, an automobile can be operated about 98 per cent of the time without necessitating the shifting of gears or the operation of the clutch.

The engine is simply started in high and with the clutch engaged. The automobile can then be started and stopped innumerable times, as when driving in traffic, without shifting gears. It is merely necessary to press on the accelerator. The car can even be started on hills with the transmission gears in high. Practically the only time when it is necessary to release the clutch and shift gears is in reversing the car or if rapid acceleration is desired in starting. No matter how hard the accelerator pedal is depressed, the car will start without the slightest jerk. Another advantage is that stalling of the engine is eliminated.

This fluid coupling consists of a driving member which is bolted to the crankshaft and a driven member which transmits power through the friction clutch and transmission to the rear axle of the automobile. Both members of the fluid coupling are cylindrical and are closed at opposite ends. They are provided with internal blades, welded in place. These two members comprise a steel cylindrical casing which is partially filled with a light mineral oil.

When the engine is started, the driving member of the coupling revolves and causes oil to be directed against the blades of the driven member, the latter member starting to revolve and drive the car as the force of the oil becomes greater. The higher the speed of the engine, the greater the force of the oil and the faster the speed at which the driven member of the fluid coupling and the car are driven. There is no mechanical connection between the two coupling members, and therefore none between the engine crankshaft and the automobile transmission. This fluid coupling is now provided as standard equipment on the Custom Imperial line of Chrysler automobiles.

* * *

Exports of Industrial Machinery from the United States

The exports of industrial machinery from the United States during the month of October were valued at $20,875,000. Of this, power-driven metalworking machinery accounted for $7,513,000, an increase of 33 per cent over the exports of this class of machinery for October last year, which amounted to $5,647,000. Noteworthy increases were recorded in the exports of milling machines, turret lathes, grinding machines, sheet and plate metalworking machines, and rolling mill machinery.

* * *

Industrial Machinery Trade of Sweden

In 1937, the imports of industrial machinery into Sweden were valued at approximately $20,000,000, an increase of 25 per cent over the imports in 1936. The exports of industrial machinery from Sweden were valued at $16,000,000 in 1937, as compared with $11,000,000 in 1936.

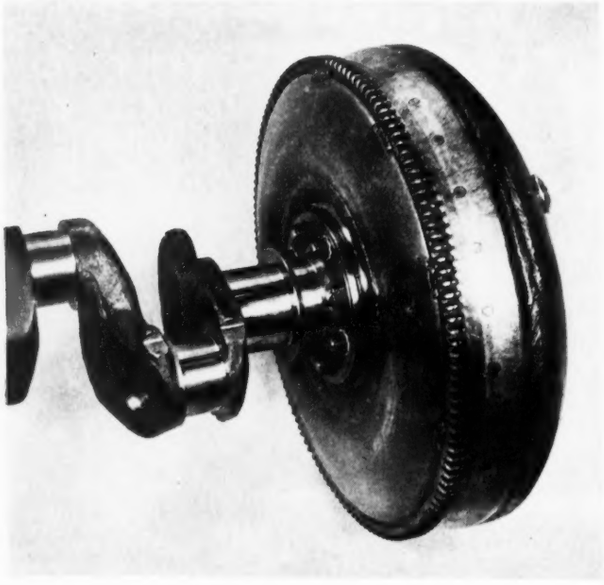


Fig. 1. The Chrysler Fluid Drive Unit Mounted on the Crankshaft

Fig. 2. Driving Member of Fluid Drive (Left) and Driven Member (Right)

Die Design and Construction

A Treatise on the Principles Embodied in the Design of Different Types of Sheet-Metal Blanking, Forming, and Drawing Dies—Ninth of a Series of Articles

By CHARLES R. CORY*

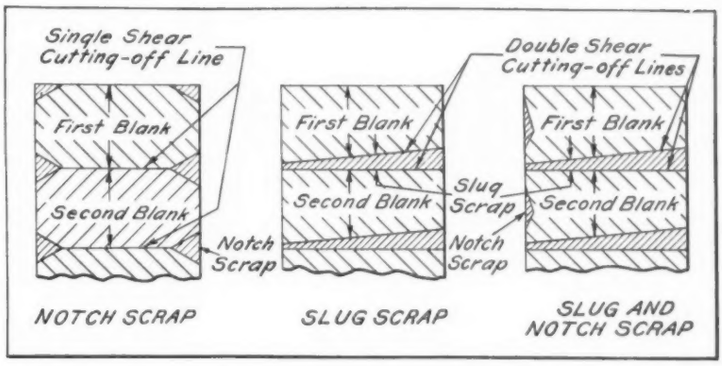


Fig. 1. Diagrams Showing Scrap Left when Blanking Parts with Non-parallel Sides in Cutting-off Dies

THIS article will deal with a type of die which may best be described as a shear type piercing and cutting-off die. A cutting-off die is a variation of a blanking die. The latter shears a blank from a stock strip, cutting on all sides of the blank. A cutting-off die shears a blank from the stock strip without cutting the sides of the blank, since the sides of the stock strip become the sides of the blank.

In the simplest form of cutting-off die, there is no scrap, since the blanks are sheared from the stock strip by a single cut. This is not the case, however, if the blank is not a parallelogram, since there will then be some scrap in the form of slugs. These slugs may be notched out of the stock strip in a stage before the cutting off, or the blank may be separated from the stock strip by cutting out a slug. Fig. 1 shows blanks produced in cutting-off dies when there is scrap left in the form of slugs.

The reasons for using cutting-off dies rather than blanking dies are (1) stock is saved; (2) the operation is faster; and (3) the die cost is lower.

Stock is saved because there is no scrap at the sides of the blank in any case, and no scrap at all in case the blank is a parallelogram. The operation is faster because there is no stock strip scrap to be handled, since any scrap is in the form of separate slugs which are disposed of automatically. In the case of a wide stock strip, one operator may be saved, since with the ordinary type of blanking die an extra operator may be required at the back of the press to handle the scrap. This is especially true if the blanking die is of the double-run type. The same speed of operation can be obtained, however, with a single-run blanking die as with a cutting-off die if scrap cutters are used and the blanking die is so constructed that the scrap will shed off the die.

The cost of making a cutting-off die is somewhat lower than that of a blanking die because the length of the punch and die cutting edges is less. If the total number of blanks to be cut by the die is high, the die cost saving is not important. If the die is to be used for a comparatively small number of blanks, however, it may be an important factor. Another saving in die cost is the possibility of using a standardized cutting-off die for different parts. If the only difference between the blanks is the length, this can be provided for by adjusting the end gage.

One disadvantage of the cutting-off die, as compared with the blanking die, is that the scrap stock from some other part cannot be used, unless it is of such size that it can be sheared to strips of uniform width.

There are two types of cutting-off dies, the shear type and the slug type. In the shear type, the blank is severed from the stock by a shear punch cutting the stock strip along one shear line only. This type of die is used primarily for blanks with front and rear outlines parallel, so that there is no scrap, as indicated at *A* in Fig. 2.

In the slug type, a double-shear cutting-off punch severs the blank from the stock strip by cutting out a slug, as indicated

*Die Engineer, Fisher Body Division, General Motors Corporation, Detroit, Mich.

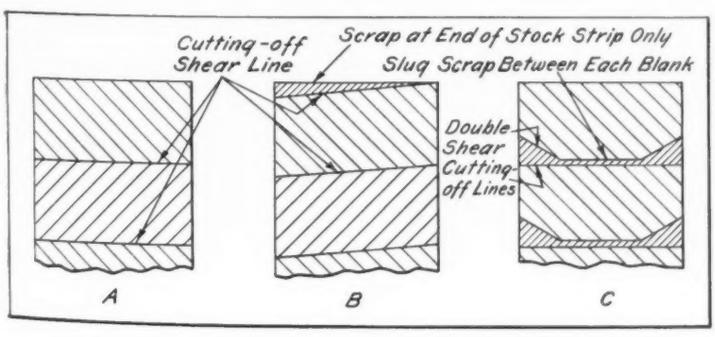


Fig. 2. Methods of Cutting off Blanks with Parallel and Non-parallel Sides

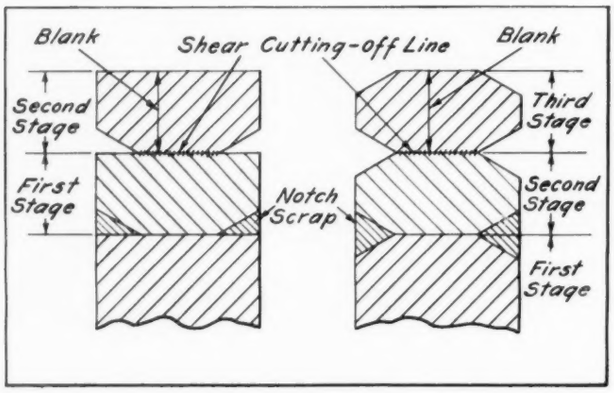


Fig. 3. Method of Cutting off Blanks with Notch and Shear Type Cutting-off Dies

at *C* in Fig. 2. The double-shear punch cuts along two lines, one the shape of the front of the blank and the other, the shape of the rear of the next blank. This type of die is used for blanks with parallel sides, but with front and rear outlines that are not parallel.

A shear type die can also be used for such blanks, if part of the front and rear outlines are parallel, by notching out the non-parallel part of the front and rear outline in a previous stage (Fig. 3). The advantage of the shear type for such a blank is the saving in stock, which would be important in the case of a high-production die; and the disadvantage is the somewhat higher die cost, which would be important for a low-production die.

A diagrammatic view of the shear type piercing and cutting-off die is shown in Fig. 4. On the down stroke of the press, the cutting-off punch shears the blank from the stock strip. On the up stroke, the blank falls or slides from the die. The stock strip is prevented from moving upward by either a spring or a solid stripper. The operator then feeds the stock strip against an end gage and the process is repeated. If the front end of the blank is not square with the sides of the stock strip, it is obvious that a new stock strip must be gaged by sight, to cut off a small amount of scrap with the first die stroke.

Because of the piercing operation, a two-stage die is required. The holes in the blank are pierced in the first stage and the stock is then fed to a new position and the blank is cut off from the stock strip while holes are being punched simultaneously in the next adjoining blank. A finished blank is thus produced at each stroke of the press, but it requires two strokes to finish any particular blank.

If the holes to be pierced are very close to the edge of the blank, the lower cutting-off member or die will be weakened. This difficulty can be overcome by the use of a three-stage die, piercing the holes in the first stage and cutting off the blank in the third stage. In the second or middle stage, no operation would be performed on the strip. If the holes to be pierced are so close together that the die will be too weak, then the piercing operations can be split up into two stages, again using a three-stage die. Obviously, a three-stage die requires a preliminary gage for gaging the stock at the first and second strokes on a new stock strip.

Many operations can be combined to reduce the number of dies for producing a part to the minimum. There is a greater possibility of combining operations in the piercing and cutting-off die than there is in the blanking and piercing die type.

Construction of Details of the Die Member

In constructing a cutting-off die, a side clearance between the punch and die cutting-off members of 10 per cent of the stock thickness should be provided. If the stock to be cut is over 1/16 inch thick, it is customary to back up the die member by a shoulder on the die-shoe casting or else by a key. The sidewise thrust of cutting through heavy stock may be too great for the dowels in the die member without this positive backing. The top face of the die is not usually relieved to form a "land," as in the case of ordinary blanking dies. The relief would interfere with the feeding of a new stock strip into the die.

The cutting-off die may be provided with holes for the piercing punch, either directly in the die member or in a die button, as indicated in Fig. 6. A stock channel is attached to the top of the die member. The stock channel and the cut-off die may be fastened to the die-shoe with one set of screws and dowels. The die cutting-off member is, of course, made from hardened tool steel. A vertical land, 3/8 inch high, is provided at the cutting edge, below which there is a clearance for relief, as shown.

Die buttons can be pressed in place either in the cutting-off die or in a separate die-button retainer

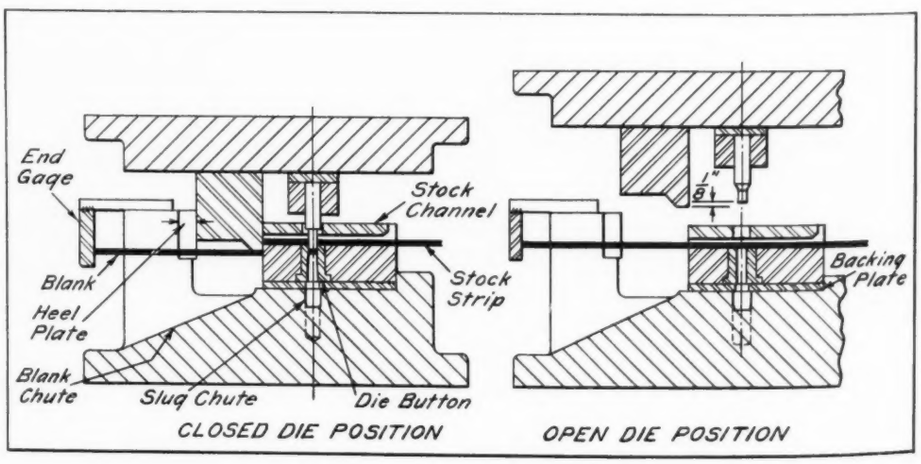


Fig. 4. Diagrammatic View of Piercing and Cutting-off Die

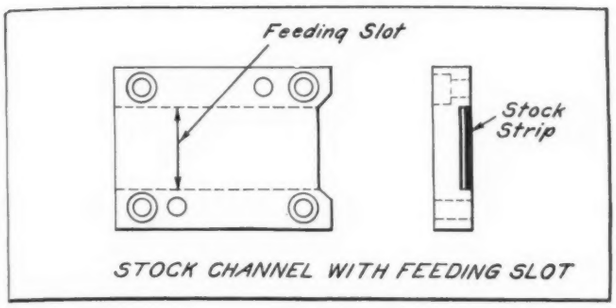


Fig. 5. Stock Channel with Feeding Slot

plate. The die button is provided with a head to prevent it from being pulled out of the die or retainer. The die button should be made of hardened tool steel.

If the holes to be pierced are not round, it is necessary to prevent the die buttons from turning. This is done by methods such as have been described in connection with the article on piercing and blanking dies. (See MACHINERY, June, 1938, page 699.)

The hole in the die button has vertical sides for about 3/8 inch from the top. This part of the hole clears the punch on each side by an amount of 10 per cent of the stock thickness. Below the vertical land the hole tapers, as described in connection with the piercing punches used with blanking and piercing dies. What was mentioned in that connection with regard to die-button backing plates also applies here. The design and construction of the die-button retainer plate would also be similar to that for a regular blanking and piercing die.

Design of the Stock Channel

The stock channel is a flat soft steel plate with a feeding slot cut in its under surface, as shown in Fig. 5. The stock channel guides the stock strip and also strips it from the piercing punches on the up stroke of the press. The stock channel is similar to the solid stripper sometimes used on a drop-through blanking die. It is important to make the feeding slot wide enough to take care of possible variations in the width of the stock strip. Whether the stock strip is purchased in lengths of the required width or sheared from wider sheets of metal, variations must be expected, and it is advisable to make the feeding slot 1/16 inch wider than the nominal stock width.

The depth of the feeding slot should be somewhat less than twice the stock thickness, so that a new stock strip when used to push the last part of the preceding strip through the die will not be able to slide on top of the old strip and jam in the slot. At the entering end of the feeding slot the stock channel should be chamfered to facilitate the starting of a new strip of stock.

The side gaging of a cutting-off die is not very accurate, due to the fact that the stock channel has a liberal side clearance. In the case of a blanking die, the accuracy of the side gaging does not affect the size or shape of the blank, since the sides of the stock strip are not part of the blank. In the case of a cutting-off die, however, the size and shape of the blank are affected, since there is no scrap at the sides to allow for inaccuracy of gaging, and the sides of the stock strip are also the sides of the blank. Parts made in a cutting-off die, therefore, are usually of a kind that will permit variations. If that is not the case, special gaging devices must be added, as will be described in a coming article.

It will be noted that in the type of die described, the stock strip is not held from shifting by spring or air pressure during the cutting-off operation. As a result, the cut is not quite so clean, and the size of the blank is somewhat less accurate than it would be in a blanking die.

* * *

Aviation Progress Calls for More Trained Mechanics

It is stated that from 500 to 700 new aviation mechanics will be required within the next year or two to maintain aviation operation. This is entirely apart from the mechanically trained men needed for building aircraft and engines. In 1938, there were approximately 3500 mechanics and ground crew men employed by the air lines in the United States. In addition, there were 6000 mechanics employed in hangars and repair shops. Thus, the total number of aviation mechanics working at the airports throughout the country was nearly 10,000. During past years, there has been an increase in this number of about 15 per cent annually. There may not be quite so large an increase in the near future, but there will be, nevertheless, a definite demand for more trained men.

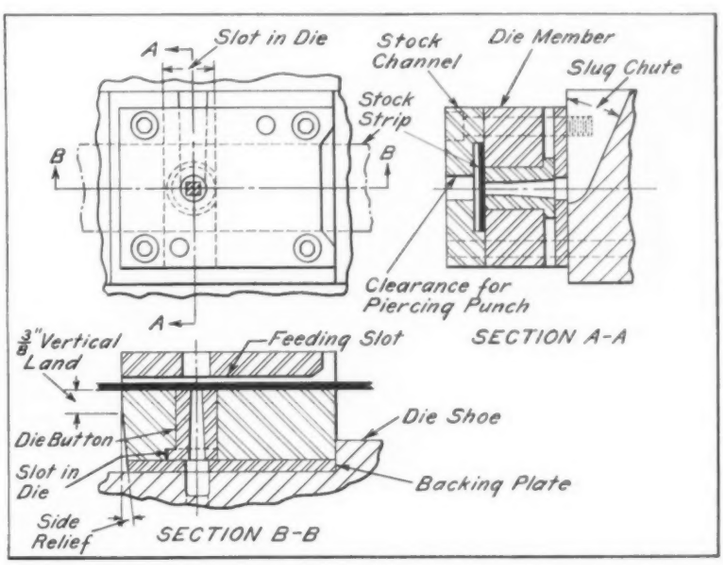
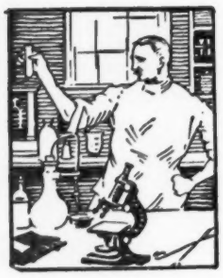


Fig. 6. Detail of the Die Member of a Cutting-off Die

MATERIALS OF INDUSTRY



THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES

Airkool—A New Die Steel with Unusual Toughness

A die steel with performance characteristics intermediate between those of high-carbon high-chromium and oil-hardening types has been brought out by the Crucible Steel Co. of America, New York City. Because of the simplicity of its hardness treatment, this new steel is called "Airkool." The steel combines air-hardening characteristics with non-deforming properties, and is especially suitable for applications in which toughness is one of the principal requirements.

Airkool is hardened by cooling in air from a temperature between 1750 and 1850 degrees F., and has an unusually wide hardening range. It can be tempered to Rockwell C. ratings from 63 to 58 by drawing at temperatures of from 300 to 1000 degrees F. Considering the machineability of carbon tool steel as 100, oil-hardening steels as 81, and high-carbon, high-chromium steels as 66, the machineability of Airkool steel would be about 74. The toughness of Airkool steel with a hardness of 60 Rockwell C. has been found to be 257 inch-pounds in a test in which the falling weight method was used on an unnotched specimen. This compares with 78 inch-pounds for a high-carbon, high-chromium steel, and 157 inch-pounds for an oil-hardening steel tested in the same manner. Wear resistance is another property of the new steel.....201

Manufactured Diamonds for Wheel-Truing Usage

Diamonds that are black in color and said to be harder and tougher than the diamonds of Mother Nature, are being made by a secret process. They are especially suitable for commercial applications, such as truing and dressing grinding wheels.

Each of these diamonds is made from a number of small ones, but the finished product is a single crystal that cannot be distinguished from a natural diamond. Chemical analyses and combustion tests have also shown that the chemical composition is that of a natural diamond.

These manufactured diamonds are said to be particularly economical in use, on account of their irregular grain structure, which is due to the grains of the small diamonds from which they are made. There is a minimum of diamond wear per dressing of a wheel, as well as high resistance to breakage, on account of the absence of cleavage lines in the stones.

These diamonds are processed in sizes from approximately 1 1/2 carats up, and without variation in quality. They are sold by the Super Tool Co., 21650 Hoover Road, Detroit, Mich. 202

Duronze Makes Possible Improved Valve Construction

An important improvement in valves manufactured by the Hancock Valve Division of Manning, Maxwell & Moore, Inc., Bridgeport, Conn., has been made by constructing a renewable-stem threaded bushing from Duronze—an aluminum, copper, and silicon alloy. The makers claim that these new bushings meet the demand for valves that will operate satisfactorily without lubrication of the stems at high pressures and temperatures. It is preferable not to have to lubricate the valve stems under these operating conditions, because the grease or oil picks up dust, ash, and pulverized coal, which act as abrasives and wear away the stems and bushings.

It is stated that valves equipped with Duronze bushings outwear many times valves not so equipped. The alloy has a very high resistance to wear and corrosion. Its tensile strength is 90,000 pounds per square inch.

The selection of this alloy was made after extensive tests in one of the country's large utility plants. Bushings of various materials and designs were tested on turbines operating on steam of 670 pounds pressure at 820 degrees F. It was found that the Duronze bushings showed no signs of wear after five times the number of reversals of the valve handwheels required to destroy bushings of other materials. 203

To obtain additional information about materials described on this page, see lower part of page 362.

Coprtex High-Temperature Blocks for Insulation Purposes

A high-temperature block known as "Coprtex" has been developed by the Armstrong Cork Products Co., Lancaster, Pa., to provide greater insulating efficiency in installations where block insulation is required. The new high-temperature block is made from a base material of copper slag wool. Its weight per cubic foot is 22 pounds, and its maximum temperature limit, 1800 degrees F. The advantages claimed for the block are low lineal shrinkage, superior insulating efficiency, sufficient softness to accommodate rivet heads and similar projections, and lightness in weight.

A Coprtex hard-surface high-temperature block is also available. It is made from the same material as the standard block, except that the exterior surface is specially treated on one or more designated sides to caseharden the surface.....204

Obtaining Smooth, Hot Galvanized Coatings on Malleable Iron

In hot galvanizing practice, the tendency is away from the use of muriatic acid and sal-ammoniac as a fluxing combination. Present methods lean toward the use of zinc-ammonium-chloride of some type to replace both the sal-ammoniac and the muriatic acid. A patented form of zinc-ammonium-chloride, known as No. 20 Flux, which is recommended both as a flux wash and, in crystal form, for use on the molten zinc, is made by the Hanson-Van Winkle-Munning Co., Matawan, N. J.

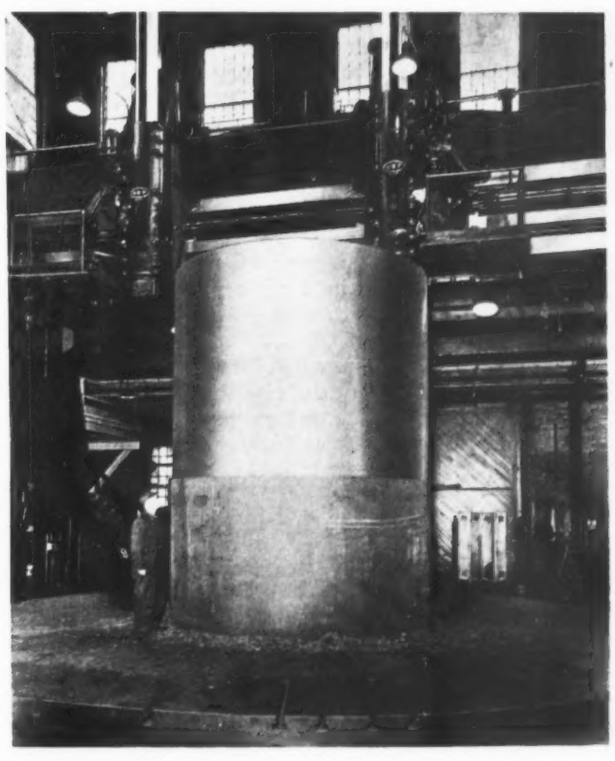
Zinc-ammonium-chloride dissolved in water replaces the muriatic acid. It is popularly referred to as a "neutral flux wash." Such a solution conducts electricity (is an electrolyte) and, therefore, should preferably be kept in a wooden tank. The crystalline zinc-ammonium-chloride is used directly on the molten zinc to replace sal-ammoniac.

The results from this practice are smoother, more ductile and adherent zinc coatings, and great reductions in dross. The elimination of muriatic acid prevents the formation of large quantities of iron chloride in the galvanizing kettle.....205

Colalloy—A New Light Non-Ferrous Metal with Outstanding Properties

A non-ferrous metal, silvery in appearance, which has only one-third the weight of steel and is unusually resistant to corrosion has recently been developed by the Colonial Alloys Co., E. Somerset St. and Trenton Ave., Philadelphia, Pa. The new alloy is said also to possess outstanding electrical and thermal conductivity, and great strength. It is easily worked, and can be formed and shaped with ease.

Because of its great resistance to corrosion, it is suitable for such applications as food containers, pans, trays, and similar articles employed in the food industries. It is also adapted for use in chemical and paint manufacturing plants, breweries, distilleries, rubber plants, tanning establishments, paper mills, oil refineries, etc. While Colalloy has a silvery appearance ordinarily, it is also available in chrome, satin, and other finishes..206



This Huge Casting was Made of Nickel-chromium Iron to Provide the Non-corrosive Properties and Strength Required in the Drier of Papermaking Machinery. It Contains Over 1 Per Cent Nickel. The Casting is 16 Feet 4 Inches High, 12 Feet in Diameter, and Weighs 108,000 Pounds. It is Shown on a Giant Boring Mill in the Shops of the Allis-Chalmers Mfg. Co., Milwaukee, Wis.

To obtain additional information about materials described on this page, see lower part of page 362.

NEW TRADE LITERATURE

Recent Publications on Machine Shop Equipment, Unit Parts and Materials. To Obtain Copies, Check on Form at Bottom of Page 361 the Identifying Number at End of Descriptive Paragraph, or Write Directly to Manufacturer, Mentioning Catalogue Described in the January Number of MACHINERY.

Welding and Cutting Apparatus

AIR REDUCTION SALES CO., 60 E. 42nd St., New York City. Catalogue 21, covering the complete line of Airco welding and cutting apparatus and supplies, and giving information on manufacturing methods and materials. This catalogue is intended especially for the larger users of equipment of this kind. Condensed Catalogue 22, containing similar material for the smaller user. 1

Arc-Welding Equipment

LINCOLN ELECTRIC CO., 12818 Coit Road, Cleveland, Ohio. Booklet entitled "The New Lincoln 'Shield-Arc'," describing a shield-arc welding machine with self-indicating dual continuous control. The bulletin discusses in detail the operation of the welder control, and also describes the performance and construction of this machine. 2

Self-Tapping Screws

PARKER-KALON CORPORATION, 200 Varick St., New York City. Catalogue describing the Parker-Kalon hardened self-tapping screws and how they are applied in more than 75,000 plants to reduce costs, improve design, and make stronger assemblies. The book also contains engineering data of value to designers and production men. 3

Forgings

STEEL IMPROVEMENT & FORGE CO., Cleveland, Ohio. Catalogue entitled "Forging Ahead with Forgings," outlining the advantages that can be obtained by the use of forgings and showing typical examples of forged parts. Information is also given on designing forgings, forging processes, and selecting steels for forgings. 4

Grinding Wheels for Thread-Grinding Machines

NORTON CO., Worcester, Mass. Bulletin 1487, containing general information on the grinding of threads, as well as specific instructions covering operating speeds, grain sizes and grades, truing, and the selection of wheels for this class of work. 5

Drum Making Machines

NIAGARA MACHINE & TOOL WORKS, 637 Northland Ave., Buffalo, N. Y. Bulletin 82, covering the methods and machines used in making steel drums, pails, and containers. Production flow charts, showing typical set-ups of machines and general outlines of methods, are included. 6

Contour Sawing Machines

CONTINENTAL MACHINE SPECIALTIES, INC., 1301 Washington Ave., S., Minneapolis, Minn. Handbook on contour sawing, containing complete engineering data on Doall contour sawing machines and methods of operation. Specific figures on the savings made with these machines in actual practice are included. 7

Safety Blow-Torches

BAUMGARTH MFG. CO., 836 Hubbard St., Chicago, Ill. Circulars descriptive of "Pumpless" safety blow-torches for use in forging iron and steel parts, cleaning and preheating parts to be welded, and other uses where an extra hot, clean, and easily controlled flame is required. 8

Flexible Metal Hose

FLEXIBLE METAL HOSE & TUBING INSTITUTE, 150 Broadway, New York City. Booklet entitled "The Fact Book of Flexible Metal Hose and Tubing," listing the principal types for the information of users and design engineers. Many uses and actual installations are illustrated. 9

Certified Steels

JOSEPH T. RYERSON & SON, INC., 16th and Rockwell Sts., Chicago, Ill. Catalogue on Certified Steels, explaining the special Certified Alloy plan in detail and showing how heat-treating costs can be substantially reduced while producing more uniform results. 10

Speed Selector

GISHOLT MACHINE CO., 1209 E. Washington Ave., Madison, Wis. Circular describing the features of the Gisholt speed selector for quickly and easily obtaining any one of the twelve available spindle speeds on Gisholt Nos. 3, 4, and 5 ram type turret lathes. 11

Monel Alloys

INTERNATIONAL NICKEL CO., INC., 67 Wall St., New York City. Revised edition of Bulletin T-9, containing information on the composition, engineering properties, and corrosion resistance of "K" Monel, together with working instructions and data on heat-treatment. 12

High-Speed Steel Tool Bits

CRUCIBLE STEEL CO. OF AMERICA, 405 Lexington Ave., New York City. Circular entitled "If Tool Bits Cost $1000 Each—Here's Why You Would Buy Rex Tool Bits . . ." giving the advantages of the seven different types of Rex high-speed steel tool bits. 13

Hydraulic Broaching Machines

AMERICAN BROACH & MACHINE CO., Ann Arbor, Mich. Catalogue illustrating and describing the features of construction of the American Type VP hydraulic, vertical, pull-up broaching machines, built to suit a wide range of internal broaching operations. 14

Small Tools

ERRINGTON MECHANICAL LABORATORY, Stapleton, Staten Island, N. Y. Catalogue covering the line of Errington production tools, including tapping chucks and tappers, toolholders, die-heads, multiple-spindle drilling heads, etc. 15

Shop Lighting Fixtures

BROWN ELECTRIC CO., 69 Morton St., Rochester, N. Y. Folder entitled

"Personalite," describing a newly designed "clamp-on" electric light useful in shop work, especially on tool or repair work, where a steady light is required at different angles. 16

Boring and Honing Machines

W. F. & JOHN BARNES Co., Rockford, Ill. Catalogue illustrating and describing the new Barnes boring and honing machines for performing any combination of boring and honing operations on a wide range of cylinder or sleeve sizes in various metals. 17

Roller Bearings

S K F INDUSTRIES, INC., Philadelphia, Pa. Catalogue describing the new S K F double-row cylindrical roller bearing which has been developed primarily for the machine tool industry, but can also be used successfully in other fields. 18

Molybdenum Cutting Steel

ALLEGHENY LUDLUM STEEL CORPORATION, Brackenridge, Pa. Circular describing a new tungsten-molybdenum high-speed steel, and giving information on the analysis and heat-treatment, as well as test data. 19

Furnace Appliances

AMERICAN GAS FURNACE Co., Elizabeth, N. J. Booklet covering improved designs of small appliances used in connection with industrial furnaces, such as blowpipes, burners, forges, soldering iron heaters, pyrometers, etc. 20

Automatic Screw Machines

NATIONAL ACME Co., 170 E. 131st St., Cleveland, Ohio. Catalogue M-39, illustrating and describing the new line of Acme-Gridley Model RA eight-spindle automatic bar machines, made in capacities of from 9/16 inch to 2 5/8 inches. 21

Center Lapping Machines

EX-CELL-O CORPORATION, 1212 Oakman Blvd., Detroit, Mich. Bulletin 10782, descriptive of the new Ex-Cell-O precision center lapping machine for use in tool-rooms and production departments. 22

Metal Parts Washing Machines

G. S. BLAKESLEE & Co., 19th St. and 52nd Ave., Chicago, Ill. Folder descriptive of the Blakeslee metal parts washing machine for washing, rinsing, drying, and cleaning metal stampings before painting. 23

Sintered-Carbide Tools

FIRTH-STERLING STEEL Co., McKeesport, Pa. Catalogue containing information on the various grades of Firthite sintered-carbide tools and their applications. Complete specifications are included. 24

Bearings and Bushings

FEDERAL-MOGUL CORPORATION, Detroit, Mich. Booklet illustrating the manufacture and various applications of engine bearings, bearing liners, and bushings, as well as bearing metals. 25

Notching Presses

V & O PRESS Co., Hudson, N. Y. Catalogue containing specifications and full-page illustrations covering the new V & O No. 410 model high-speed notching press for rotors, stators, and segments. 26

Cutting Fluids

TIDE WATER ASSOCIATED OIL Co., 17 Battery Place, New York City. Booklet covering the cutting fluids made by this company and their application in various machining operations. 27

Micarta Products

WESTINGHOUSE ELECTRIC & MFG. Co., East Pittsburgh, Pa. Leaflet 63-020, listing the standard sizes, colors, and finishes of Micarta plate and tabulating the properties and applications. 28

Precision Dowel-Pins

DANLY MACHINE SPECIALTIES, INC., 2112 S. 52nd Ave., Chicago, Ill. Chart giving data on drill and reamer sizes for dowel-pins and dimensions of standard and over-size dowel-pins. 29

Light Machine Tools

WALKER-TURNER Co., INC., Plainfield, N. J. Catalogue G9, covering

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To Obtain Copies of New Trade Literature

listed on pages 360-362 (without charge or obligation) mark with X in the squares below, the publications wanted, using the identifying numbers at the end of each descriptive paragraph; detach and mail to:

MACHINERY, 148 Lafayette St., New York, N. Y.

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the line of light machine tools made by this company for use in the metal-working and woodworking industries. 30

Ball Bearings

MARLIN-ROCKWELL CORPORATION, Jamestown, N. Y. Bulletin 25, in a series on "Ball Bearing Practices for the Shop Man," discussing the use of snap rings in ball-bearing mountings. 31

Surface Grinding Machines

ABRASIVE MACHINE TOOL CO., Dexter Road, East Providence, R. I. Bulletin containing specifications covering this company's No. 34 vertical-spindle surface grinding machine. 32

Ball and Roller Bearing Greases

E. F. HOUGHTON & CO., Third, American, and Somerset Sts., Philadelphia, Pa. Folder containing information on Houghton ball and roller bearing greases. 33

Grinding Machines

RANSOM GRINDING MACHINE CO., Oshkosh, Wis. Circular illustrating and describing Ransom constant periphery-speed grinders with direct or alternating current motor drive. 34

Diamond Wheel-Dressing Tools

KOEBEL DIAMOND TOOL CO., 1228 Oakman Blvd., Detroit, Mich. Circular illustrating Koebel multi-set, multi-point, and multi-edge diamond wheel-dressing tools. 35

Circular Saws

DELTA MFG. CO., 619 E. Vienna Ave., Milwaukee, Wis. Circular announcing new features of the Delta line, including the Unisaw, a circular saw of the tilting-arbor type. 36

Cushioned Air Cylinders

NOPAK MFG. CO., 2727 S. 31st St., Milwaukee, Wis. Bulletin illustrating and describing the complete new line of Nopak cushioned air cylinders. 37

Electric Buffers and Grinders

STANDARD ELECTRICAL TOOL CO., 1938-46 W. 8th St., Cincinnati, Ohio. Bulletin 104, illustrating and describing the company's new line of "Cadet" buffers and grinders. 38

Casehardening Baths

A. F. HOLDEN CO., New Haven, Conn. Bulletin announcing a new development in casehardening baths for obtaining maximum results at minimum costs. 39

Variable-Speed Transmissions

LENNEY MACHINE & MFG. CO., Warren, Ohio. Catalogue describing the principle of operation and applications of Lenney variable-speed transmissions. 40

Speed Control Units

REEVES PULLEY CO., Columbus, Ind. Circular illustrating the operating principle and showing typical installations of the Reeves Motodrive, or speed control unit. 41

Ball Bearings

NEW DEPARTURE DIVISION GENERAL MOTORS CORPORATION, Bristol, Conn. 1939 edition of Booklet R9, containing ball-bearing interchangeability tables. 42

Surface Grinding Machine

HILL CLUTCH MACHINE & FOUNDRY CO., Cleveland, Ohio. Bulletin H-1, descriptive of the Hill hydraulic, horizontal, precision surface grinder. 43

Disk Sanders

OLSEN ENGINEERING CO., Rockford, Ill. Booklet illustrating and describing Olsen 30- and 36-inch disk sanders for wood pattern makers. 44

Nickel-Clad Steel

LUKENS STEEL CO., Coatesville, Pa. Bulletin T-4, containing information on methods of fabricating Lukens nickel-clad steel. 45

Power Transmission Equipment

RAMSEY CHAIN CO., INC., Albany, N. Y. Catalogue 638, covering the Ramsey line of high-speed silent chain drives. 46

To Obtain Additional Information on Shop Equipment

Which of the new or improved equipment described on pages 363-374 is likely to prove advantageous in your shop? To obtain additional information or catalogues about such equipment mark with X in the squares below, the identifying number found at the end of each description on pages 363-374—or write directly to the manufacturer, mentioning machine as described in January MACHINERY.

51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69
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To obtain additional information about any of the materials described on pages 358-359 mark with X in the squares below, the identifying number found at end of each description on pages 358-359—or write directly to the manufacturer, mentioning name of material as described in January MACHINERY.

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[SEE OTHER SIDE]

Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market

W. F. & John Barnes Boring and Honing Machine

A machine capable of both boring and honing cylinders in a wide range of diameters and lengths has been designed and built by the W. F. & John Barnes Co., Rockford, Ill. This machine is intended for application in industries manufacturing airplane parts, hydraulic cylinders, bearings, oil-well tubing, recoil cylinders, hydraulic jacks, combustion-engine cylinders and sleeves, and cylinders in general. In plants where the production rates and the nature of the work warrant, the machine can be furnished for boring operations alone or for honing operations alone. In either case, the other method of finishing cylinder bores is available, and the machine can be equipped for it later if desired.

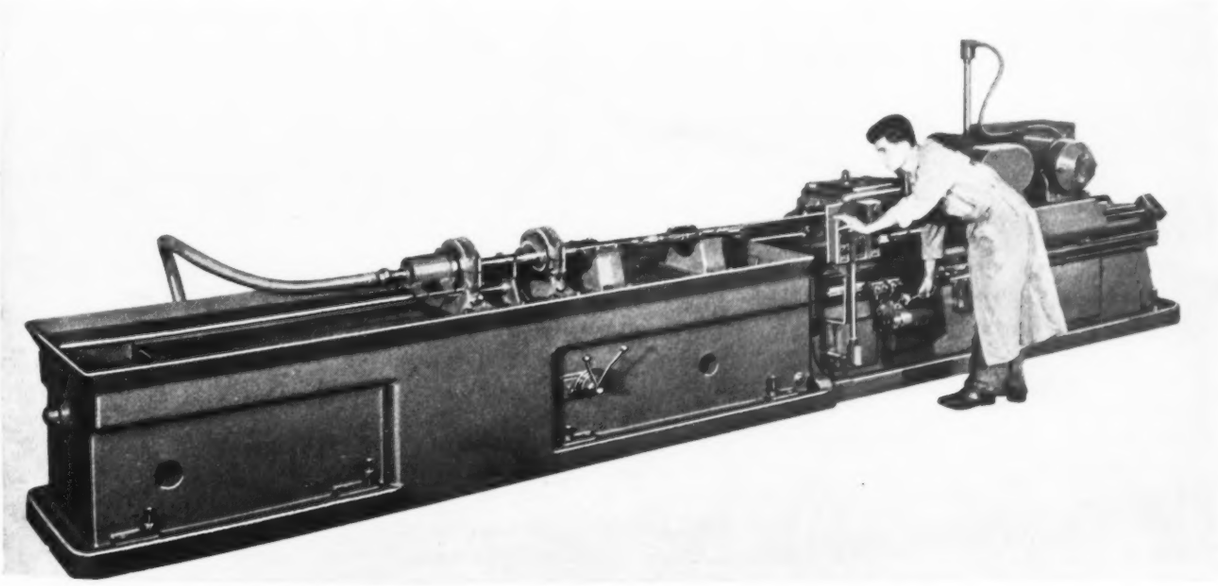
The head is designed to use the Micromatic hydraulically controlled hones. A Barnes hydraulic unit mounted on the machine provides for the wide combination of head feeds required for boring and honing operations on the machine.

The head housing is of a light aluminum alloy. The drive to the spindle from the motor mounted on the head is through V-belts to pick-off speed-change gears, from where the power is transmitted through a worm to a worm-wheel directly connected to the spindle. This mechanism is enclosed in the head housing, and lubricated by an individual pump in the head. All bearings are of the anti-friction type.

A limit switch, interlocked with the honing cycle, stops the spindle motor at the moment that the hone is withdrawn from the bore.

The head feed is independent of the spindle speeds, permitting a large range of feed and speed combinations. The boring feeds vary from 0.062 inch to 12 inches per minute, controlled by means of a hand-adjusted dial mounted on the hydraulic unit. The rapid traverse for boring is at the rate of 30 feet per minute. The honing feed is adjustable between 35 and 60 feet per minute. The spindle speeds range from 66 to 600 revolutions per minute.

After the machine is set up for boring or honing, it is completely controlled by push-buttons and levers. The machine, while boring, is manually operated with the "feed-engaged lever" and "feed-direction selector." Adjustable positive trip-stops furnished for long cuts and blind-end boring permit the operator to leave the machine without damaging the work. The honing cycles can be manually controlled or automatically controlled by trip-dogs. Aside from tool and fixture change-overs —and in some cases relocating of dogs—the machine is available for boring or honing without further changes. 51



W. F. & John Barnes Machine for Boring and Honing Cylinders

To obtain additional information on equipment described on this page, see lower part of page 362.

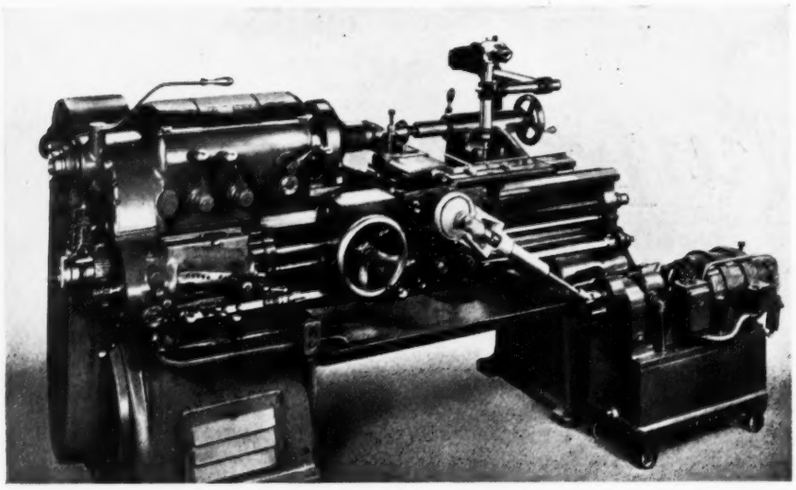


Fig. 1. The Reed-Prentice Universal Duplicator as Applied to a Tool-room Engine Lathe

Reed-Prentice Universal Duplicator

A combination hydraulically and electrically controlled duplicator attachment is being marketed by the Reed-Prentice Corporation, Worcester, Mass., for use on vertical milling machines for die work and on tool-room engine lathes for face and circular form-turning. The same attachment can also be applied to horizontal boring mills for die work, and to planers and shapers for form-planing and shaping of molds and dies. The attachment can be applied to any standard machine, and can be quickly changed from one machine to another. It does not interfere with the ordinary use of a standard machine.

The attachment as ordinarily applied to a milling machine permits of form or contour milling in one plane, but it can also be furnished for three-dimensional milling by having a small hydraulic motor connected to the longitudinal cross and vertical feeds, using one pump and electric control unit for the three movements. 52

Dumore "Tom Thumb" Grinder

A precision grinder for small lathe work, known as the "Tom Thumb" grinder, has been designed by the Dumore Co., Racine, Wis., for small internal and external grinding work. While of extremely small size, it is adapted for a wide range of work, and has many uses other than grinding, such as polishing, carving or routing, etc.

Driven by a 1/14-horsepower motor, it is capable of spindle speeds of from 8500 to 19,000 revolutions per minute, and handles wheels varying from 1/8 inch to 2 inches in diameter. The distance from the spindle center to the base is 1/2 inch, and from the spindle center to the toolpost, 7/8 inch. The weight of the grinder is 6 1/4 pounds. 53

Bradford Six-Unit Automatic for Operations on Oil-Pump Bracket

The Bradford Machine Tool Co., 657-671 Evans St., Cincinnati, Ohio, has recently built, for the manufacturer of a well-known automobile, a machine for performing a number of operations on the oil-pump bracket. In general principles of design, this machine is similar to that illustrated and described in March, 1938, MACHINERY, page 463. It consists of six Bradford automatic drilling units, with a five-station horizontal index-table carrying quick-acting fixtures, which hold one part at each station. The machine is almost entirely of welded steel construction, with the exception of the housings of the units and the fixtures.

The features include the use of three inverted units with sealed spindles which come up to the work through the chip and coolant trough; an inverted position for the work, so that it is held underneath the fixture table rather than on top of it; complete electrification, with fully enclosed motors having push-button control; and a synchronization of all movements by limit switches and relays. The production obtained by this machine is one-hundred and fifty oil-pump brackets drilled, counterbored, spot-faced, core-drilled, and tapped per hour. 54

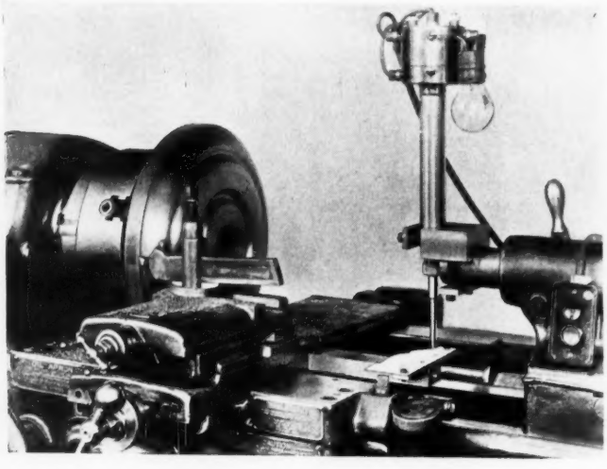
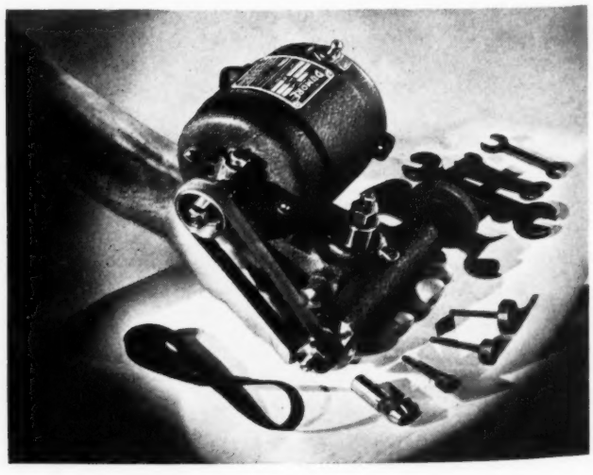


Fig. 2. View Showing Guide of Universal Duplicator Used for Face-forming in an Engine Lathe

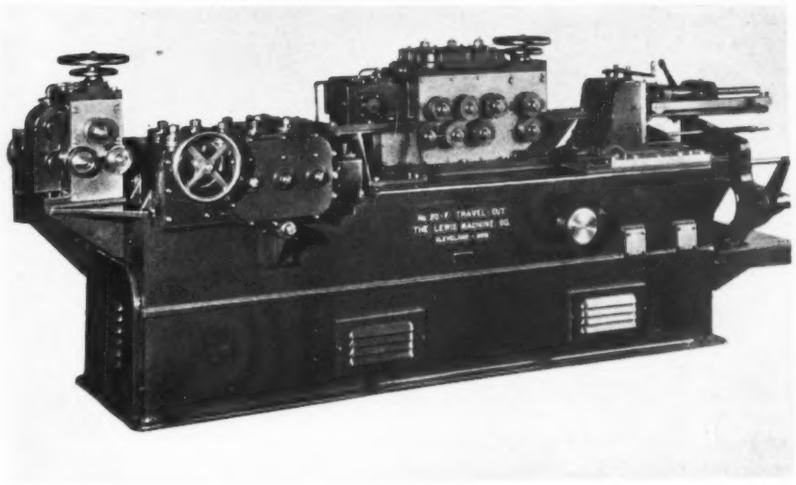


Dumore Precision Grinder for Small Lathe Work, Weighing only 6 1/4 Pounds

To obtain additional information on equipment described on this page, see lower part of page 362.

Lewis Straightening and Cutting Machine

An addition has been made to the "Travel-Cut" line of wire straightening and cutting machines built by the Lewis Machine Co., 3441 E. 76th St., Cleveland, Ohio. The new model, known as the Lewis No. 20-F Travel-Cut shape straightening and cutting machine, is equipped with a flying-shear type cut-off, and is designed to handle square, flat, hexagon, and shaped rod. It has a capacity for 5/8 inch square rod or equivalent area, and will handle flats up to 2 1/2 inches wide. The cutting of any length required is controlled by a simple adjustment of the gage.



Lewis "Travel-Cut" Straightening and Cutting Machine

Among the features incorporated in the design of this machine may be mentioned the use of eighty-eight anti-friction bearings; all rolls power-driven; all main drive units, including flywheel, clutch, and cut-off mechanism, fully enclosed in oil-tight housings; forced-feed lubricating means to the cut-off head ways; centrally located oil-tank and pump, providing oil for the preliminary roll-straightener, horizontal-straightener, and vertical-straightener housings; and silent multiple V-belt drive from a 30-horsepower motor. 55

Gisholt Speed Selector for Turret Lathes

A device known as the Gisholt speed selector, for obtaining quickly any one of the twelve spindle speeds on Gisholt Nos. 3, 4, and 5 ram type universal turret lathes, has been placed on the market by the Gisholt Machine Co., 1209 E. Washington Ave., Madison, Wis. The device is power-operated; the operator simply sets a dial, and the machine automatically makes the shift to the correct spindle speed.

The speed selector provides for three methods of operation. The first is the "direct" method, in which the spindle speeds are changed simply by turning the dial to the desired speed or to the diameter of the cut being taken. Immediately, the machine automatically makes the shift.

In the second, or "pre-set" method, the spindle speed for the next cut can be selected and pre-set in advance of the actual speed change; that is, while one cut is in progress, the speed for the next cut can be selected by turning the dial. The speed change is then instantly made by merely touching the trip, the actual shifting being done automatically.

The third is the "high-low" method, which can be used at any time, in conjunction with either the direct or the pre-set method. The high-low method provides a quick change between high and low speeds. Frequently, a high spindle speed is required for drilling, boring, turning, or facing, and a low speed for threading, tapping, forming, or reaming. When the machine is operated at any one of the six high speeds, a corresponding low speed is instantly provided by merely pressing the trip. All spindle speed changes are made without stopping the spindle or releasing the main-drive clutch.

A handwheel controls both the inner and outer dials. The twelve spindle speeds are marked on the outer dial; the work diameters, from 1/4 inch to 12 inches, are marked on the inner dial. The cutting speeds (40 to 600 feet per minute) are seen through the opening in the handwheel. The cutting speed for the metal turned and the tools used is set by the knurled wheel. It is not necessary to change the setting until different metal or cutting tools are used. 56

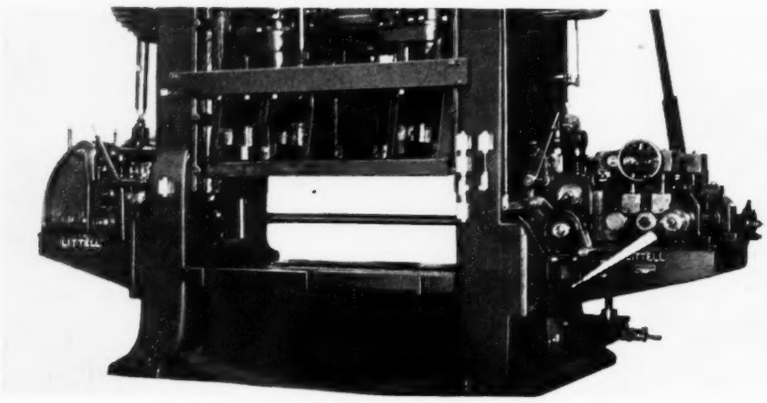
Gisholt Speed Selector for Turret Lathes

Stewart-Warner Alemite Fitting for Heavy Machinery

A new free-flow giant Alemite button-head fitting, designed to speed up the lubrication of heavy machinery, has been brought out by the Stewart-Warner Corporation, 1826 W. Diversey Parkway, Chicago, Ill. Bearings requiring large amounts of lubricant can be lubricated more rapidly than with the older types of fittings.

In the new fitting, the usual valve core has been replaced by one that has a flat face and seat, and that, when open, offers practically no impediment to the free flow of lubricant. The improved valve opens easily under slight pressure, and provides a tight seal for the lubricant when the pressure is removed. 57

To obtain additional information on equipment described on this page, see lower part of page 362.



Littell Heavy-duty Roll Feed Applied to a 900-ton Press

Littell Heavy-Duty Roll-Feed Units

The F. J. Littell Machine Co., 4149 Ravenswood Ave., Chicago, Ill., has developed a new design of roll-feed unit, complete with straightener and scrap cutter. These feed units have a capacity for sheet stock 5/32 inch thick by 24 inches wide. To simplify the handling of such heavy stock, the feeds are equipped with "run-in" motors. A new coil of stock is started through the machine by merely pushing a control button. In an installation for a leading automobile manufacturer, the roll feeds are mounted on a 900-ton straight-sided press, as illustrated. The speed of these presses is 15 cycles per minute, with a 28-inch length of feed.

Briefly described, the equipment consists of feeding rolls 8.6 inches in diameter by 26 inches wide; a straightener that can be used as a three- or five-roll machine, with rolls 4 1/2 inches in diameter by 26 inches wide; and scrap cutters of the square shear type, with the operating connecting-rods in tension. The maximum feed length is 28 inches, but the equipment can be adapted for longer feed lengths. 58

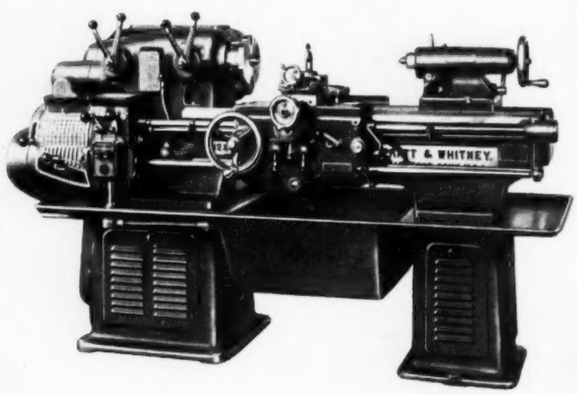
Pratt & Whitney Twelve-Inch Lathe

A 12-inch Model C lathe has just been brought out by Pratt & Whitney, Division Niles-Bement-Pond Co., Hartford, Conn. The new lathe is available in two lengths having center-to-center capacities of 30 and 54 inches. Although rated as a 12-inch lathe, the swing over the bed is 14 1/2 inches. The lathe has eighteen spindle speeds, arranged in geometrical progression up to 1500 revolutions per minute.

The three-horsepower driving motor is mounted in a cabinet leg under the headstock. A fully enclosed three V-belt drive carries the power from the motor to the main driving pulley at the rear of the headstock.

The spindle is mounted on three bearings; there are two preloaded precision ball bearings at the front end, 8 3/4 inches apart, forming a rigid support to the spindle driving gears. The third bearing is of the precision roller type and is mounted at the outer end of the spindle. The spindle nose is of the new flanged "Cam-Lock" type.

The quick-change gear-box provides sixty quick changes of feed ranging from 0.0025 to 0.152 inch. It also provides 60 quick thread changes from 1 to 60 threads per inch. At the left end of the gear-box is a removable guard which covers a quadrant and change-gear arrangement for special threads or translating gears.



Pratt & Whitney Twelve-inch Lathe

A separate feed-rod and lead-screw are used. A synchronizing high-speed clutch mechanism has been incorporated in the headstock for reversing the lead-screw and feed-rod drive. This makes it possible to reverse the carriage at high speeds without stopping.

The oiling of the carriage, apron, and cross-slide is done automatically by a small pump operated by the action of the clutch lever. This is, in effect, a one-shot type of lubrication each time the operator starts the spindle. The rear of the headstock and the bed are built out to form what is called a "column headstock." In addition to other advantages, this provides a larger surface area for the oil reservoir in the bed, so that the oil used for lubricating the spindle bearing and gears remains cool under continuous operation.

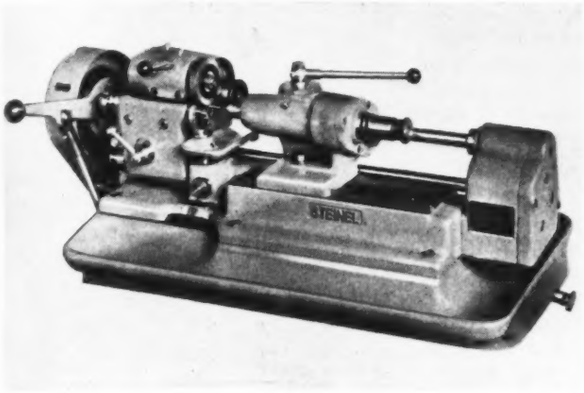
The 12- by 30-inch lathe weighs 2700 pounds without motor or starter, while the 12- by 54-inch machine weighs 3075 pounds. The width of both sizes is 31 3/4 inches, and the lengths 88 and 112 inches. 59

Steinel Pivot Burnishing Machine

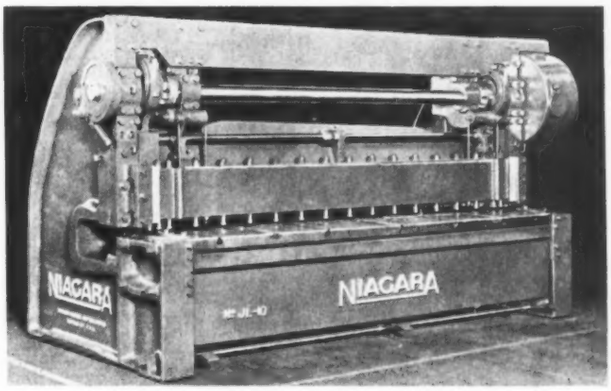
A pivot burnishing machine with several new features has been placed on the market by the George Scherr Co., 128 Lafayette St., New York City. This machine is designed for burnishing shafts and pivots of small pinions to a uniform diameter, true roundness, and smooth bearing surfaces. It is equipped with micrometer adjustment for diameter control, and can be used by an unskilled operator. It saves from three to five times the time required for doing the work by hand.

Among the improvements incorporated in the new model are a lever for feeding in the work—the feed now being by means of a rack and pinion instead of using the old yoke type feed; the burnishing wheel bearing is longer; the foot treadle is at the head instead of at the tail end of the machine; and the belt and pulley are enclosed. A reservoir holds the used oil. The machine can be used with

To obtain additional information on equipment described on this page, see lower part of page 362.



Steinel Improved Pivot Burnishing Machine



Niagara Series JL Power Squaring Shear

tungsten-carbide wheels, giving from twenty to twenty-five times longer life between grindings to the burnishing wheel.

It is stated that this machine will finish bearings, pivots, and similar parts produced on automatics to a tolerance of 0.0004 inch. In taking off 0.001 to 0.002 inch of material, from 600 to 900 shafts per hour can be finished with this accuracy. 60

Akron Mechanical Feeder for Portable Screwdrivers

The Akron Automatic Machine Co., 100 Beech St., Akron, Ohio, has developed an attachment adapted to any portable power screwdriver. This device is primarily a mechanical feeder which, in addition, confines the screwdriver blade and screw-head during the whole driving time, so that, regardless of what type of screw is being used, the blade cannot slip out of the screw-head and spoil either the screw or the work.

The device is provided with an adjustable limit control which is set to insure driving screws to the desired degree of tightness without depending upon the operator. The operator is provided with a number of auxiliary magazines, which can be loaded from a power-driven hopper. From these auxiliary magazines, the screws are instantly transferred to the working magazine without manual handling of individual screws. The device weighs less than 1 1/4 pounds, and thus adds but little to the weight of the screwdriver to which it is attached. 61

Niagara Power Squaring Shears

In the accompanying illustration is shown one of a complete new line of Series JL power squaring shears of 1/4 inch capacity, built in several standard cutting lengths, recently placed on the market by the Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo, N. Y. These shears have a completely enclosed drive, with gears mounted in anti-friction bearings and running in oil. They have a fourteen-point sleeve clutch with built-in single-stroke mechanism. The steel cross-head is of triangular section. The machine is provided with the latest type of ball-bearing, self-measuring parallel back-gage, and is fully accessible at the rear for setting the back-gage and for easily removing sheared pieces. 62

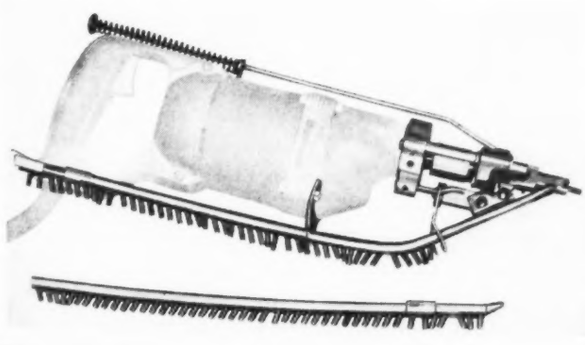
Landis Expanding-Chaser Collapsible Tap

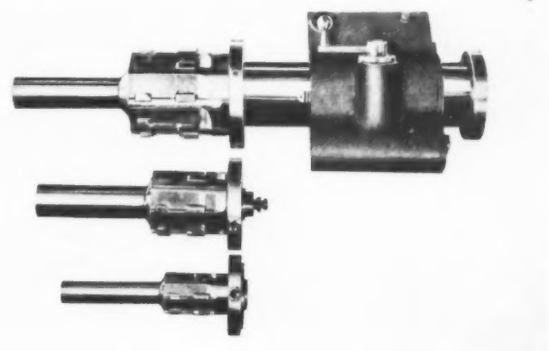
A tap known as the Landis Style LBSR expanding-chaser collapsible tap has been designed by the Landis Machine Co., Inc., Waynesboro, Pa., for production boring and tapping of flanges and similar work. The tap was originally developed for the Gisholt "Simplimatic," but it can be adapted to any other machine used for similar operations.

As shown in the illustration, a boring and tapping head are mounted tandem on the tap body to provide for taper-boring the hole and tapping the thread in one pass of the tool. A pilot bar attached to the boring head and fitting a bushing in the machine spindle supports the tap and aligns it properly with the work.

This design permits using several sizes of tap heads on one tap body. Two sizes of bodies are available, the No. 4 LBSR, carrying from 3- to 5-inch heads, and the No. 6 LBSR

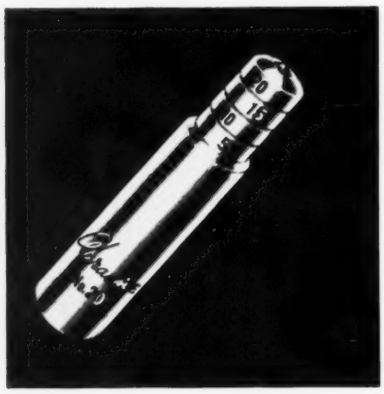
Akron Automatic Machine Co.'s Feeder for Portable Screwdrivers





Landis Style LBSR Expanding-chaser Collapsible Tap

To obtain additional information on equipment described on this page, see lower part of page 362.



Abrasive Dressing Tool Co.'s Diamond Dressing Tool

carrying from 4- to 12-inch heads. The tap can be designed for any desired thread length ranging from 2 1/4 inches maximum for the 3-inch head, to 3 7/8 inches maximum for the 12-inch head.

A positive adjustment feature, which is self-locking, is provided to maintain accuracy of size. The expanding action is obtained through a single solid transverse sliding cam, similar to the cam used in the Style LM and Style CBLM Landis taps. In the new tap, however, the forward movement of the plunger, which produces the expanding action of the cutters, is obtained by reversing the angle on the taper control cam.

The taper control cam is arranged for cutting 3/4 inch taper per foot. Adjustment is provided to correct any slight variation in this taper. In order to change the taper, it is only necessary to release a locking screw in the control collar and move the taper indicator. Extremely accurate and very small adjustments can be made.

The tripping mechanism of the tap is positive, with a large wearing area, so that there will be no appreciable wear after a long period of use. The tap is free from any openings through which chips or dirt can enter to cause undue wear or interfere with the operation. 63

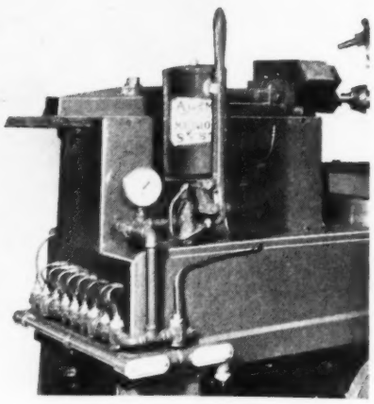
"Abrasive" Diamond Dressing Tools

The Abrasive Dressing Tool Co., 1550 Broadway, Detroit, Mich., has brought out a new line of diamond dressing tools based on a new method of setting the diamonds for which patent applications are now pending. The new process involves the heating of the diamonds in a multi-metal matrix. The entire fusing of the metals around the diamonds is completed in twenty seconds, with no chance for metal oxides to form.

The No. 20 cluster type dressing tool shown in the illustration is intended for medium-sized wheels. There are four layers with five diamonds to the layer, weighing 2 1/2 carats. This tool is recommended for general tool-room work, as well as for production applications. 64

Improved Lubrication of Bilgram Gear Chamfering Machine

An improvement has been made in the gear chamfering machine built by the Bilgram Gear & Machine Works, 1217-1235 Spring Garden St., Philadelphia, Pa., which has previously been illustrated and described in MACHINERY. The improvement consists in adding a one-shot lubricating system, so that, through this one-shot lubrication, all the parts on the machine, with the exception of the head, will be lubricated. The lubricating operation requires less than a minute's time. The lubricating device is placed on the machine, is easily accessible, and does not in any way interfere with the operation of the machine. 65



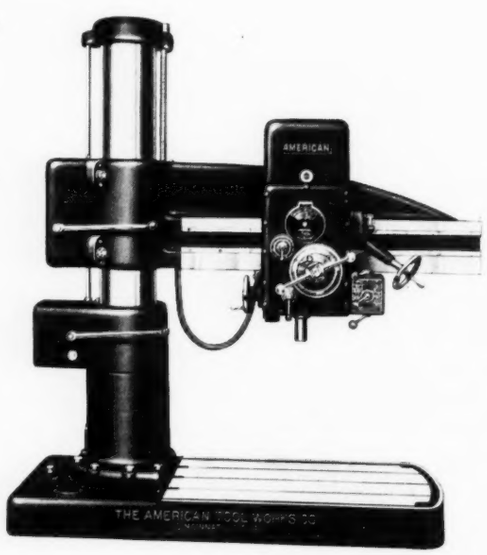
One-shot Lubrication System for Bilgram Gear Chamfering Machine

American Radial Drills

A new design of radial drill known by the trade name American "Hole Wizard" radial, has been added to the line of the American Tool Works Co., Cincinnati, Ohio. This machine is built with an 11-inch diameter column, and is driven by a five-horsepower built-in, high-reversal, ball-bearing motor. The machine is available in arm lengths from 3 to 6 feet, inclusive, to cover a wide range of drilling, tapping, and boring operations. It has twelve spindle speeds up to a maximum of 3000 revolutions per minute, six geared feeds, and a 12-inch spindle travel.

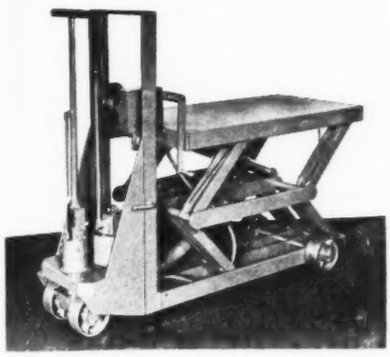
To provide smooth power transmission and a quiet drive even at the highest speeds, the spindle drive is through hardened and ground helical gears. The spindle and sleeve are made from Nitralloy steel, nitrided to provide unusual surface hardness. The close fit possible between these hardened members makes for accurate drilling and boring in tool-room operations, diemaking, and jig boring, the maker having designed the machine not only for speed and economy in performing conventional operations, but for accurate work in tool-rooms and die shops.

The driving sleeve is mounted on Timken precision bearings at top and bottom, with means for take-up in case of wear. This feature insures not only a practically frictionless drive, but one in which the original accuracy can be maintained for years. 66



American "Hole Wizard" Radial Drill

To obtain additional information on equipment described on this page, see lower part of page 362.



Hydraulic Elevating-table Truck Made by Lyon Iron Works

Lyon Truck with Hydraulic Elevating Table

A truck with hydraulic elevating table, as shown in the accompanying illustration, has been developed by the Lyon Iron Works, Greene, N. Y. Among the specific uses for this type of truck may be mentioned the handling of sheet metal for feeding shears, punching machines, presses, etc., the truck enabling the operator to raise the sheets to a convenient height for feeding. The truck is also suitable for handling heavy rolls and for dies to be placed in or taken out of presses.

A winch is mounted on the front end of the table and is elevated with it. This winch is used for pulling the rolls or dies onto the table. The table of the truck shown is 24 inches wide by 48 inches long; its low height is 20 inches, and it can be elevated hydraulically to a height of 43 inches. Any required variations in sizes of table tops and elevating heights are obtainable. A Lyon two-speed hand-operated hydraulic pump furnishes power to the rams operating the table. 67

General Electric Ignitron Contactors

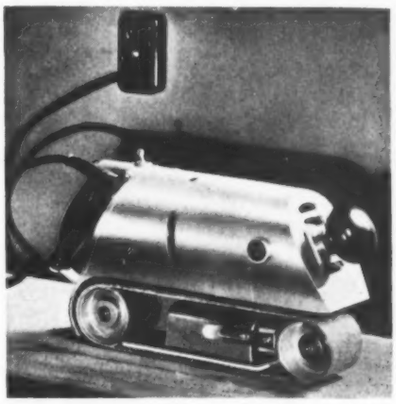
A line of ignitron contactors for spot projection and flash welders has been brought out by the General Electric Co., Schenectady, N. Y. For the new contactor, many advantages are claimed: It is quiet in operation, even when rapidly interrupting hundreds of amperes; it has no moving parts; the maintenance cost is low; and the ignitron tubes can be replaced quickly.

The new device is particularly suitable for high-speed welding applications, as, for example, in the manufacture of automobile bodies or in the fabrication of other sheet-metal products. The contactors are available in ratings of 150, 300, 900, and 2500 amperes. 68

GuildTool Portable Electric Belt-Sander

A portable electric belt-sander weighing only 9 pounds has been added to the line of tools made by the Syracuse GuildTool Co., Syracuse, N. Y. The new machine is known by the trade name "GuildSander." It is especially designed to make available to the average workman the advantages of the belt type sander and to eliminate hand sanding, surfacing, and refinishing. It is suitable for sanding all straight or slightly curved surfaces. The front pulley can be used as a spindle-sander. The machine will also do light grinding on straight-grain metal, and will sharpen hand tools.

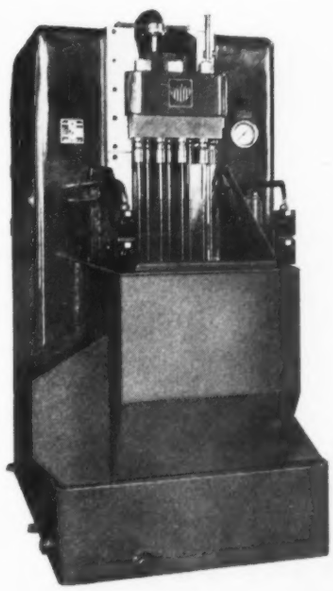
The machine is built with a die-cast aluminum frame, finished in baked aluminum enamel. The endless abrasive belts travel 600 feet per minute. They are 2 inches wide by 21 inches in circumference, and available in all suitable grits. Belts can be changed instantly by means of a patented catch-and-release spring plate. The sander is equipped with a 110-volt universal motor, either alternating or direct current. 69



Portable Belt-sander Built by Syracuse GuildTool Co.

American Hydraulic Broaching Machine

The American Broach & Machine Co., Ann Arbor, Mich., is building a new Type VP hydraulic broaching machine which is an improvement on the vertical internal broaching machines manufactured by the company for many years. These vertical, pull-up, internal machines are built in several different sizes and tonnages to suit a wide range of internal broaching operations. The machine illustrated has full automatic control for high production requirements. Semi-automatic machines of this type are used where the production requirements are less severe.



Hydraulic Broaching Machine Built by the American Broach & Machine Co.

The machine column is integral with the lower base. The broach-pulling cylinder slide is the moving or sliding member of the machine. Its massive weight produces a balancing effect on the cutting tools. The cylinder proper is approximately 25 per cent longer than the stroke. This allows for a maximum of guiding surfaces and insures alignment and long life. The piston-rod is the fixed member, bolted to the bottom of the machine in the base. A Sundstrand variable-delivery pump operates the broaching cylinder. A small auxiliary pump of constant-delivery type is provided for operating the broach elevating cylinder.

The drive is from a motor through V-type belts, the belt tension being adjustable by screws on the motor bracket. The machine is controlled by push-buttons with emergency stop. An inching button is also provided for setting the tools.

In operating the semi-automatic machine, the operator places the work over the shank of the broaches. He then presses the push-button, and

To obtain additional information on equipment described on this page, see lower part of page 362.

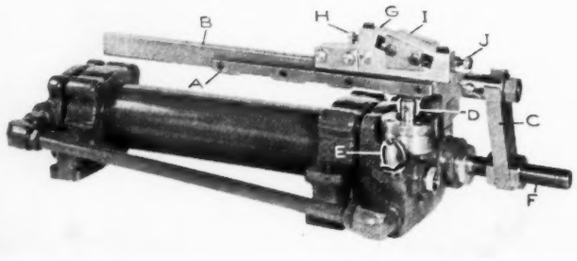
the hydraulic broach elevator raises the broaches automatically, connecting them to the broach heads. The main pulling cylinder then pulls the broaches through the work. At the end of the cutting stroke the work drops from the broaches, and is deflected to the discharge chute by a work deflector plate.

The main pulling cylinder returns downward and the broaches are automatically disconnected from the pull-heads as the cylinder reaches its lowest position. The broaches are then lowered by means of the elevator cylinder, and the operator can place new work on the broaches and start a new cycle. 70

Chiksan Ball-Bearing Swing Joints

Chiksan Oil Tool Co., Ltd., Fullerton, Calif., has brought out a line of 3/8- and 1/2-inch ball-bearing swing joints made from steel, which are designed for use in machine shops and for all applications requiring a small flexible joint. These joints permit of complete 360-degree rotation without binding, and are so designed that there is nothing to get out of adjustment. In ordinary service, they do not require greasing after installation. The joints are made in three styles to meet varying requirements. They are provided with standard pipe thread connections. 71

Chiksan Ball-bearing Swing Joint



Arrangement of LeMaire Feed-control Cylinder for Hydraulic Feeds

LeMaire Feed-Control Cylinder

A feed-control cylinder for use on machines equipped with hydraulic feed has been developed by the LeMaire Tool & Mfg. Co., 2657 S. Telegraph Road, Dearborn, Mich. This device can be arranged for handling a sequence of feed and rapid traverse movements, with quick return to starting point; or it can be used for any required sequence of feed and rapid traverse movements on both the forward and return strokes. The cylinder is of standard design, with the exception of the control cam, which is made to give the required valve control for each individual case.

The cylinder is built with a "metering" valve, set for the desired rate of feed, and a by-pass valve for the rapid traverse movements. The valves for either feed or rapid traverse are tripped by a cam *A* carried on slide *B*. This slide is pivoted on yoke *C* and has a slotted opening for the pivot, so that the cam-slide is free to rise or fall as the cam passes over roller *D*. As shown in the illustration, the roller is passing over a high point on the cam. Feeding takes place when the roller is on either of the high points, and rapid traverse during the interval that the roller is passing over the low points of the cam. As the plunger carrying cam-roller *D* rises or falls, it trips the valve, permitting the passage of oil through a by-pass for rapid traverse. When the by-pass is closed, oil passes through the metering valve only, thus giving the desired rate of feed.

Briefly, this is what happens as the feed control cylinder passes through a complete cycle: As the piston and piston-rod *F* moves forward, shoe *G*, carried by the cam-slide, also moves until screw *H* comes into contact with the cam-block located in an inclined cam groove in the shoe. This cam-block is held in a fixed position on the frame of the cylinder at *I*. As shoe *G* moves forward, the entire slide on which cam *A* is carried moves down through the action of the cam carried in the slot in shoe *G*. Screw *H* is adjusted and locked to provide for depressing the cam-slide sufficiently so that roller *D*, in running over the cam, can open or close the by-pass.

On the reverse stroke, yoke *C*, moving with the piston-rod, carries the cam-slide and shoe *G* in the reverse direction. In so doing, the cam-slide and cam are lifted sufficiently so that roller *D* and its plunger keep the by-pass valve open at all times if rapid traverse is required for the entire reverse stroke. Should intermittent feed and traverse movements be desired on the return stroke, screw *J* is so adjusted that the cam-block in the slot in shoe *G* does not lift the cam from roller *D* far enough to prevent the cam from controlling roller *D* to open the by-pass valve to give the required sequence of feed and traverse.

This feed-control cylinder can be connected with two or more plain cylinders, thereby controlling the fluid to give the required sequence of feed and rapid traverse. The feed cylinders can be arranged in parallel or in series, as required. 72

Flexible-Shaft Grinder

The Lea-Nard Co., 96 Warren St., New York City, has brought out a flexible-shaft grinder known by the

Redcap Flexible-shaft Grinder

To obtain additional information on equipment described on this page, see lower part of page 362.

trade name "Redcap" which, arranged as shown in the accompanying illustration, is suitable for sawing, routing, drilling, and grinding operations. It consists of a 1/16-horsepower universal type motor with rubber-covered cord and plug; a variable-speed foot rheostat; a flexible shaft 37 inches long from the motor to the hand-piece; and a ball-bearing hand-piece with a No. 0 balanced Jacobs chuck and a No. 52 mounted wheel point. The chuck has a capacity of from 1/8 inch down to No. 80 drills. The maximum speed is 12,500 R.P.M. The weight, with rheostat, is 8 pounds; without rheostat, 6 pounds. 73

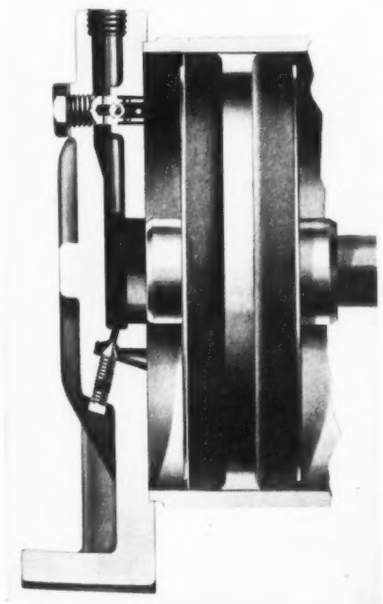
Hanna Adjustable Cushion for Air Cylinders

To meet the demand for a cushion that can be adjusted for the variables of air velocity, stroke, and relation of cylinder capacity to load, the Hanna Engineering Works, 1765 Elston Ave., Chicago, Ill., have developed the cushioning arrangement shown in the illustration.

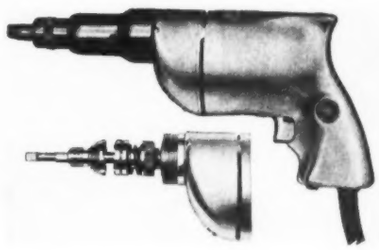
Once adjusted, the cushioning is entirely automatic. As the cushion sleeve enters the cylinder head, the air trapped between the piston and the head forms a cushion. Thereafter the speed at which the piston continues to move to the end of its stroke is controlled by an adjustable needle valve.

Upon reversal of the piston travel, it is essential that live air act immediately upon the full area of the piston; this is accomplished by the ball-check valve shown, without which the reversal of the piston stroke would be very slow. In fact, live air acting on only the cushion sleeve area might be insufficient to move the load.

Air cylinders with this new development are available in diameters from 2 to 20 inches, inclusive. Where heavy loads and long strokes are involved, modifications may be made to provide greater cushioning area and stroke. In addition to the cushion control, these cylinders are equipped with speed boxes to control the full piston travel. 74



Hanna Adjustable Cushion for Air Cylinders



New Van Dorn Screwdriver for Production Work

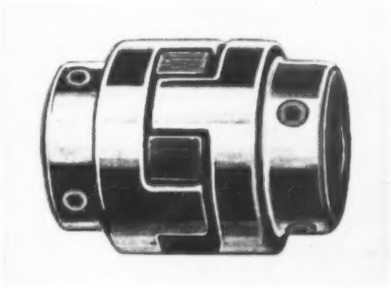
Van Dorn Adjustable-Clutch Screwdriver

A screwdriver for production work, known by the trade name "Scrugun," has been introduced to the trade by the Van Dorn Electric Tool Co., Towson, Md. The new screwdriver is designed along the lines of the Van Dorn "Holgun." The adjustable clutch can be set for any desired tension, and the free spindle idles until the operating pressure causes engagement of the clutch jaws. The clutch is quickly adjusted by turning a knurled collar.

The tool has a screwdriving capacity for No. 4 to No. 12 screws. The standard no-load spindle speed is 750 revolutions per minute; the net weight is 3 3/4 pounds; and the over-all length, including bit, is 9 1/2 inches. 75

Lovejoy Safety Flexible Coupling

A flexible coupling is being made by the Lovejoy Flexible Coupling Co., 5021 W. Lake St., Chicago, Ill., especially for safe operation in industries where explosive and inflammable gases, vapors, and liquids are handled and where the possibility of a spark might be dangerous. The body of this new coupling is made of Tobin bronze, which will not cause sparks under any condition. The spider or resilient load cushion is made from rubber, duck, leather, or brake lining material of woven asbestos. The three-piece construction —two Tobin bronze flanges and a one-piece cushion spider—facilitates assembly and installation. The couplings require no lubrication.

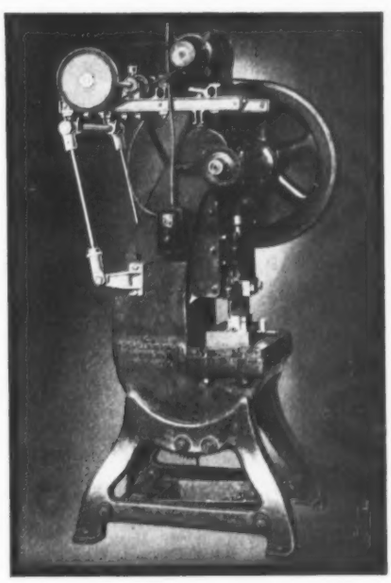


Lovejoy Safety Coupling with Tobin Bronze Flanges

These couplings, known as the L-R Type I-A "Safety" couplings, are made in two standard sizes, with bores from 1 inch to 2 1/4 inches, inclusive, to transmit from 2 to 90 horsepower at 1750 revolutions per minute. 76

"Remco" Punch Press Drive

The Remco Products Corporation, State and Hay Sts., York, Pa., has recently designed the punch press drive shown in the accompanying illustration. Any standard 1750-R.P.M.



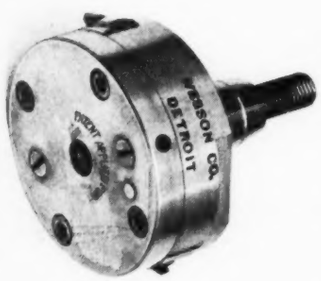
Remco Drive Applied to a Punch Press

To obtain additional information on equipment described on this page, see lower part of page 362.

motor can be used with this drive. The countershaft acts as a speed reducer. The adjustable countershaft and the adjustable motor base both act as belt tighteners. The bed rails are adjustable in or out to suit the conditions of the press and to bring the pulley driving the flywheel not only in direct line with it, but in such a position that there will be no shaft overhang. 77

Wesson Boring Head

A fully automatic collapsible boring head with two or more blades, positive in action, has been placed on the market by the Wesson Co., 1050 Mt. Elliott Ave., Detroit, Mich. Although especially adapted for cylinder boring, this automatic boring head is equally suitable for producing accurate and highly finished holes in sleeves and similar work. The tool has been designed especially to insure accuracy in size, roundness and straightness, high quality of finish, and high production. It is primarily intended for use with cemented-carbide tool bits. 78



Wesson Automatic Collapsible Boring Head

Brown & Sharpe Permanent Magnetic Chuck

A rotary model permanent type magnetic chuck has been added to the line of rectangular model chucks made by the Brown & Sharpe Mfg. Co., Providence, R. I. This magnetic chuck is offered by the company for sale only in the United States and its territories. As may be recollected from the description previously published of the rectangular model chucks, these permanent magnetic chucks do not require electric current.

The circular model is comparatively light and compact, and can be rotated without vibration at reasonable spindle speeds. It is suitable for cylindrical grinding, internal and external, as well as for face or disk grinding. It is also applicable for light cuts on lathes, especially for work that is difficult to hold in ordinary chuck jaws. The amount of energy or holding power of the chuck is controlled by giving the operating handle a part turn, a feature that permits work located on the partially energized face to be moved or tapped into position and accurately centered.

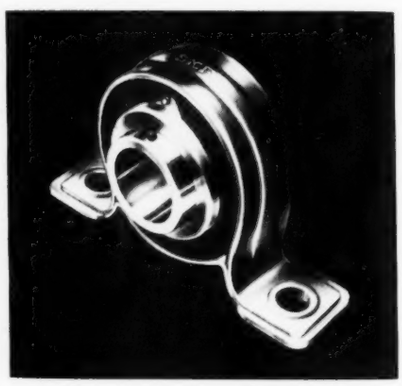
The chuck does not become heated under any conditions, and work can be held on it as long as desired without damage to the work or chuck. Also, since the chuck does not operate with electric current, there is no danger of the work being released due to power failure. 79

B & S Rotary Model Magnetic Chuck

SKF "Rubberflex" Pillow Block

A compact, sound-insulated pillow block, known by the trade name "Rubberflex," has been placed on the market by the S K F Industries, Inc., Front St. and Erie Ave., Philadelphia, Pa. In this unit, a self-locking bearing of the well-known S K F "Grip-Lock" type is used. This bearing is self-aligning, thus compensating for inaccuracies of set-up and shaft misalignment without impairing the load-carrying capacity.

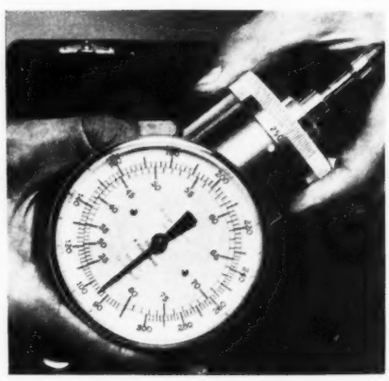
The bearing is encased in a pressed-steel housing with felt seals and with means for lubricating. The bearing and housing are surrounded by an elastic material that has sound-absorbing properties and is impervious to oil and grease. The new pillow block finds wide application in fields requiring anti-friction bearings with unusually quiet operating characteristics. The units will be made at first for 3/4- and 1-inch shaft sizes. 80



S K F Sound-insulated Pillow Block

S & S Jeweled Tachometer

A universal hand tachometer especially designed for plants where speeds over a wide range are to be measured has been brought out by George Scherr Co., 128 Lafayette St., New York City. This instrument, known as the S & S jeweled hand tachometer, contains eight jewels, an improvement that adds to the life of the bearings, reduces repair costs, and insures accuracy at high speeds.



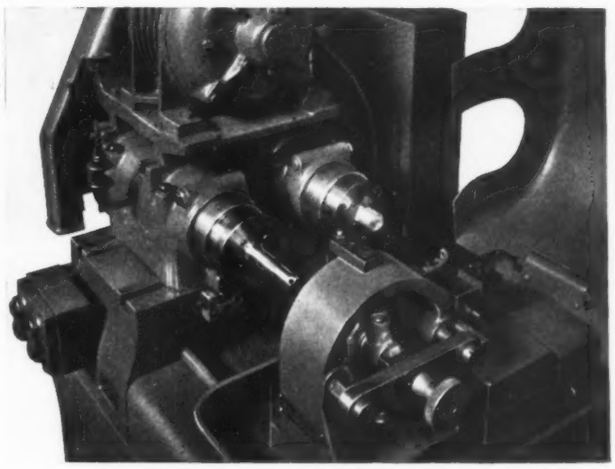
S & S Hand Tachometer Reading up to 40,000 R.P.M.

The tachometer is manufactured in two models, one for speeds from 30 to 40,000 revolutions per minute and the other for speeds from 25 to 30,000 revolutions per minute. The pointer makes two turns around the dial, giving readings on two sets of numerals. Speed ranges from 30 to 400, 300 to 4000, and 3000 to 40,000 are thus read on one model, and from 25 to 300, 250 to 3000, and 2500 to 30,000 on the other. The tachometer can be used for motors, engines, shafts, spindles, looms, turbines, etc., in machine shops, textile mills, and power plants. 81

To obtain additional information on equipment described on this page, see lower part of page 362.

Ex-Cell-O Retracting Spindle

A precision boring spindle that automatically retracts the tool from the work on the return stroke has been developed by the Ex-Cell-O Corporation, 1212 Oakman Blvd., Detroit, Mich. The spindle is interchangeable with the standard Ex-Cell-O boring spindles, so that it can be installed on machines equipped with other types of spindles.



Ex-Cell-O Automatically Retracting Boring Spindle

The retracting action is obtained through a simple mechanism. The spindle is hollow, surrounding a shaft that slides in the hollow spindle. On the end of the spindle is a tool-carrying quill that is free to move at right angles to the spindle axis, in the plane of the cutting tool axis. Inside, the quill is machined with two opposed tapers—one concentric with the lengthwise axis of the quill, and the other a small amount off center.

At the rear end of the spindle, a hydraulic cylinder is bolted to the spindle flange. The function of this cylinder is to move the central shaft lengthwise a small amount in the spindle. When the shaft is pulled back through the spindle, a tapered portion of the quill end of the shaft engages the rear taper in the quill, centralizing the quill with the spindle and locking the two in the cutting position. When the hydraulic action pushes the shaft forward, the shaft engages the off-center taper toward the front of the quill, thus retracting the tool from the work. 82

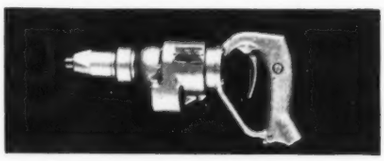


Fig. 1. Rotor Tool for Heavy-duty 1/4-inch Nut-setting

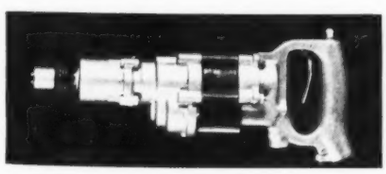


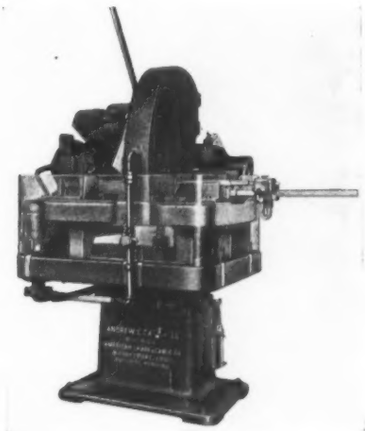
Fig. 2. Type of Tool Having 1/2 Inch Capacity for Nut-setting

Rotor Tools with Triple-Action Impact Clutches

The Rotor Tool Co., 17325 Euclid Ave., Cleveland, Ohio, has brought out a new line of adjustable impact clutches applied to air nut-setters and screwdrivers ranging in capacity from 1/4 to 3/4 inch. These clutches apply the impact principle to screwdriving and nut-setting. This increases the turning effort of the clutch, so that it is greatly in excess of the torque supplied by the motor. First, the torque of the motor drives the nut down; then the triple-action clutch, giving three impacts per revolution, sets the nut to a predetermined tension. The torque at which the nut is set and the clutch released is governed by an adjustable spring.

The impact members of the clutch consist of three steel balls which serve as drivers and carry the load. They run in three equally spaced raceways in the upper half of the clutch, which has three hardened steel "interruptions." Standard balls are used which are quickly and cheaply replaceable. An auxiliary spring-opened clutch keeps the nut sockets stationary when starting or idling until pressure is applied to the tool.

Fig. 1 shows the Type E-O M-1084 tool for heavy-duty 1/4-inch nut-setting, and Fig. 2 the E-1C M-1094 tool of 1/2 inch capacity. Nut-setters are available in larger sizes up to 3/4 inch, with spade handle or with side handles. 83



Campbell Abrasive Cutting Machine

Campbell Abrasive Cutting Machine

An improved abrasive cutting machine, known as the Campbell No. 213, has been placed on the market by the Andrew C. Campbell Division, American Chain & Cable Co., Inc., Bridgeport, Conn. The machine is designed to cut tubing up to and including 3 1/2 inches in diameter, and solid bars up to and including 2 inches. A new coolant system distributes coolant equally to both sides of the abrasive wheel. The coolant box side walls are movable and can be pushed out of line without damaging them. Pieces of a broken wheel drop completely through the distributor, without clogging, falling into the main

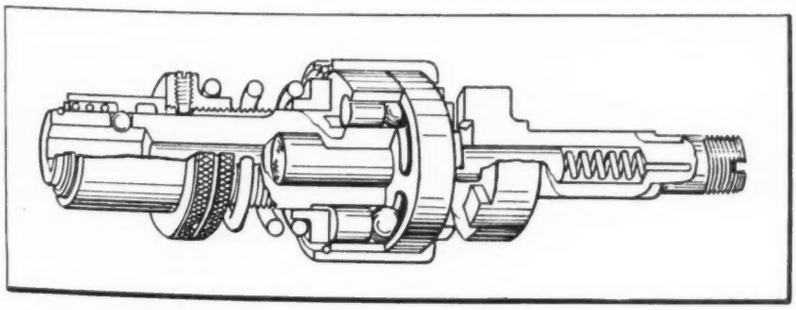


Fig. 3. Design of the Rotor Triple-action Impact Clutch

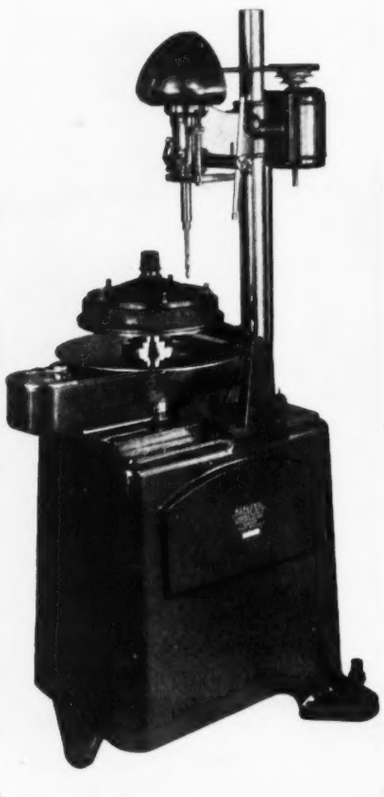
To obtain additional information on equipment described on this page, see lower part of page 362.

coolant pan. A micrometer stop bar can be set to any length without the use of measuring tools, to an accuracy of plus or minus 0.020 inch.

Holding pressure clamps, coolant shut-off, reversible work-holder liners, and improved wheel guards are other improvements incorporated in the machine. 84

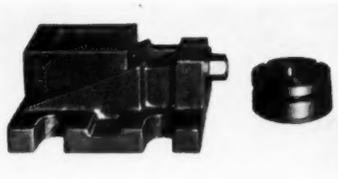
Micro-Poise Balancing Machine

A new model of the machine known as the "Micro-Poise" balancing machine has been placed on the



New Model Micro-Poise Balancing Machine

market by the Commerce Pattern, Foundry & Machine Co., 2211 Grand River Ave., Detroit, Mich. This machine is designed to show instantly the amount and location of unbalance in such parts as flywheels, fans, clutches, brake-drums, grinding wheels, or any narrow-faced rotating parts. The indicated unbalance is corrected by turning the work to bring the heavy side under the drilling unit. A feed dial on this unit is graduated to indicate the amount of metal to be removed by the drill to bring the part into balance. 85



Two Sizes of Baker Bros. Alignment and Leveling Jacks

Baker Bros. Alignment and Leveling Jacks

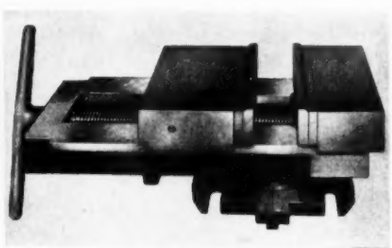
Three new alignment and leveling jacks for machine tools have been placed on the market by Baker Bros., Inc., Toledo, Ohio, known as the Nos. 41, 42, and 43 jacks. The No. 41 jack is for use with lathes, milling machines, and similar equipment. As shown at the right in the accompanying illustration, it is 4 inches in diameter, 2 1/4 inches maximum height, and has a screw adjustment with a 1 5/8-inch range.

The No. 43 jack, as shown at the left in the illustration, is made for large planers, boring mills, and similar heavy machines. Its size is 9 by 8 by 4 3/4 inches, with an angle slide adjustment range of from 4 1/4 to 5 inches.

The No. 42 jack is similar in design to No. 43, but is intended for small planers and boring mills. Its size is 5 3/4 by 5 by 3 inches, with an adjustment range of from 2 3/4 to 3 1/4 inches. 86

Kravan Machine Vise with Downward Gripping Action

The Kravan Co., 125 Maple St., Waterbury, Conn., has brought out a new machine vise having jaws that exert an equalized face grip and also a downward pull, which automatically levels the work without requiring tamping against either the precision-machined base of the vise or parallels placed between the base and the work. As the downward gripping action and the equalized side pressure on the jaws take place simultaneously, no distortion or slippage of the work occurs. 87



Kravan Machine Vise with "Down Grips"

* * *

An Accomplishment of the Machine and the Engineer

In commemoration of the sixtieth anniversary of the forming of the organization which today is the General Electric Co., this company has published a number of figures that indicate what the electrical industry has provided for the average citizen through its growth and development in the last sixty years. This record of progress is also an indication of what the machine has done for the comforts and the standard of living of the average man, since all these accomplishments would have been impossible without machinery.

In 1878, practically no incandescent lamps were sold; in 1937 such sales totaled 955,000,000. In 1888, there were only a few scattered homes wired for electricity; today there are 23,000,000 such homes. Even twenty years ago there were no radios and no electric refrigerators; today 26,500,000 homes have radio-receiving sets and 11,250,000 have automatic refrigerators. Twenty years ago there were only 3000 homes with electric ranges; today there are 2,000,000 thus equipped. Few electric motors were available in 1888; today 41,000,000 horsepower of motor power is available for factory use alone. It requires but little imagination to visualize how all this has contributed to a higher standard of living.

* * *

New Jersey Invites Industries

The New Jersey Council, created to spread information on the industrial advantages of the state, has published a pamphlet entitled "New Industrial Digest of New Jersey," copies of which may be had by writing the New Jersey Council, Trenton, N. J. The pamphlet contains much valuable information relating to the industrial areas of New Jersey and the advantages of locating industrial plants in these areas.

* * *

It is estimated that 7,800,000 people in the United States are wholly dependent on the automobile and bus for local transportation, because they reside in communities not served by railroads.

To obtain additional information on equipment described on this page, see lower part of page 362.

Organizing and Operating a Job Welding Shop

IN a paper by Howard McCord, foreman of the welding department, and Fred H. Drewes, consultant, of the W. G. Jarrell Machine Co., Charlotte, N. C., which received the first main award of over $3750, in the commercial welding group of the competition sponsored by the James F. Lincoln Arc Welding Foundation, Cleveland, Ohio, a number of suggestions for the successful operation of a job welding shop are given.

The equipment of a job welding shop for high-grade work should consist of the following:

Metallographic Equipment—Micro camera; microscopes; polishing wheels; belt grinders; grinding wheels; dark-room equipment.

X-Ray Equipment — Low-voltage machine (capable of penetrating 1-inch plate).

Physical Testing Equipment—Portable tensile and bend testing machine; hydraulic tester.

Arc-Welding Equipment—Single-operator 200-ampere set; gasoline-engine trailer model arc welder, 300 amperes; two welding tables; two welding booths; two shields.

Machine Tool Equipment—Power hacksaw; milling machine; surface grinder; bench lathe.

Miscellaneous Equipment — Air compressor; plate storage racks; specimen cabinets and display boards; hand tools; quenching tanks; lantern slide projector; projection screen; work-bench equipped with vise and built-in cupboard.

Accessories — Electrode-holders; wire brushes; fiber helmet; fiber hand-shield; welding gauntlets (leather and asbestos); welding goggles; two 50-foot lengths of hose or one 50-foot length of twin hose.

Power Supply—110-volt alternating current (single phase); 220-volt alternating current (three phase); 110-220-volt direct current.

Additional facilities may be required for operating on a production basis, as, for example, a designing or drafting-room able to design the product in a preliminary way before the job is accepted, and to make detailed drawings before the job is sent to the shop.

The following thicknesses of plate have been found suitable to carry in stock: 1/4, 1/2, 3/4, 1, 1 1/4, 1 1/2, 1 3/4, 2, 2 1/4, 2 1/2, 2 3/4, 3, 3 1/2, 4, 4 1/2, 5, 5 1/2, 6, 6 1/2, and 8 1/2 inches. The following sizes of round bars should be carried in stock: 1/2-, 3/4-, 1-, 1 1/4-, 1 1/2-, 1 3/4-, 2-, 2 1/2-, 3-, 3 1/2-, 4-, 6-, 9-, 12-, 14-, and 16-inch diameter. The material kept in stock should also include standard sizes of channels, I-beams and angles, and, of course, the necessary stock of different sizes of welding rods and electrodes.

Hiring and Training Welders

It is essential that an arc welder should have a knowledge of the fundamental principles involved in arc welding. He should have a knowledge of electrical terms and of the practical units used in electrical calculations. He should have knowledge of the installation, adjustment, and operation of the welding equipment in use in the shop to which he has applied for a position.

An applicant for the position of an experienced arc welder should be able to give the proprietor or foreman of the job welding shop a few practical demonstrations of his ability and knowledge. He may qualify by his actual operation of the electric arc welding equipment and his ability to use both the coated and the uncoated electrode according to correct welding procedure. Manufacturers of electric welding rods furnish the purchaser with literature giving complete description of the electrode, its recommended uses, physical properties, general description, and welding procedure, from which the applicant's ability to qualify as an experienced welder can be checked.

Welding Business Promotion

To make known the facilities available for job welding, the welding shop will resort to various ways of advertising and sales promotion. In smaller communities, there is newspaper advertising to be considered. Cards and blotters can be used. Window displays furnish good advertising and attract the passerby. The appearance of the shop and office is of value in promoting the business. Direct-by-mail advertising can often be used to advantage. A careful study of figures submitted by a prominent accountant indicates that job welding shops in large cities spend about 1 per cent of their total gross sales for advertising, one-half of which may be spent for direct-by-mail advertising to reach prospective customers in the local area.

In contacting customers, the questions to be kept in mind are (1) What classes of business are available in the immediate vicinity within easy reach? (2) Which customers or prospective customers are good prospects? (3) Is the job shop equipped to serve these customers? (4) What further equipment is necessary to fit the shop to serve customers better? The job shop should be equipped to repair the worn, broken, or corroded parts of the equipment of all plants in the immediate vicinity or town in which the shop is located.

Estimating on Welding Work

In order to price work correctly, it is first necessary to determine the most economical electrode or other material to be used. When any question arises as to the most economical electrode, it is suggested that tests be run to record the time and material required for two or more electrodes. It is recognized that, occasionally, a method which is considerably quicker may be more desirable even though the cost is slightly higher than the alternative method.

The following general price schedules, on an hourly basis, are in effect in a large section of the Southeast, where agricultural and textile equipment predominates:

Shop work (other than hard facing), labor, and material, $3.50 per hour.

Shop work (hard facing), labor $2.25 per hour, plus material.

In the field, labor (welder), while operating, $4.50 per hour; labor (helper), while operating, $1.25 per hour.

Traveling time of welder, $2.25 per hour.

Traveling time of helper, $1 per hour.

Mileage for car and trailer (portable equipment), 6 cents per mile.

* * *

According to the Census of Manufactures covering production in 1937, there were in that year twenty-nine plants building motorcycles and bicycles in the United States. These plants employed approximately 7000 wage-earners. The value of the product was slightly over $36,000,000. The number of bicycles built in 1937 was 1,130,700, which was the largest number since 1899, when 1,182,700 were built.

Wallace Carrel Completes Fifty Years in Machine Tool Industry

On December 28, J. Wallace Carrel, vice-president and general manager of the Lodge & Shipley Machine Tool Co., Cincinnati, Ohio, completed his fiftieth year in the machine tool industry. It was on December 28, 1888, that Mr. Carrel entered the employ of the Lodge & Davis Co. of Cincinnati. In 1892, the Lodge & Davis Co. became Davis & Egan. Mr. Carrel left the latter concern in 1897, first going with Charles E. Billen Co. of Chicago, and later, in 1898, with Hill, Clarke & Co., Boston, Mass. In 1908 he made a tour of the industrial centers of Europe for the *American Machinist*. On February 1, 1909, he became general sales manager of the Lodge & Shipley Machine Tool Co., and in 1917, he became vice-president and general manager of the company, a position that he has held ever since.

Wallace Carrel, who has Just Completed Fifty Years in the Machine Tool Industry

Mr. Carrel's many friends throughout the machine tool industry, and among the customers of that industry, will be interested to learn that he has completed fifty years in the field that he has served so well.

* * *

Export Trade Provides Employment for Millions

A large volume of employment in the United States is dependent upon our export trade—how large can only be estimated, since exact direct measures do not exist. The Bureau of Foreign and Domestic Commerce, Department of Commerce, has attempted to estimate carefully the extent of such employment. For 1937, it is estimated that approximately 2,400,000 persons, equivalent to some 5 1/2 per cent of all gainfully employed in the United States, made their living from activities dependent on export. This was an increase of 312,000 over 1935, but was still nearly 800,000 below the 1929 level. In the machinery industries, it is estimated that 114,000 people were employed in 1929 as a result of exports of machinery. This figure was smaller in 1937, but probably not less than 75,000, and very likely considerably more.

Since exports cannot continue except when there are imports, it is evident that, contrary to popular belief, imports do not reduce the volume of work in American industries, but on the other hand, stimulate it.

New Book on Industrial Exhaust Systems

DESIGN OF INDUSTRIAL EXHAUST SYSTEMS. By John L. Alden. 220 pages, 5 1/2 by 8 1/2 inches. Published by THE INDUSTRIAL PRESS, 148 Lafayette St., New York City. Price, $3.

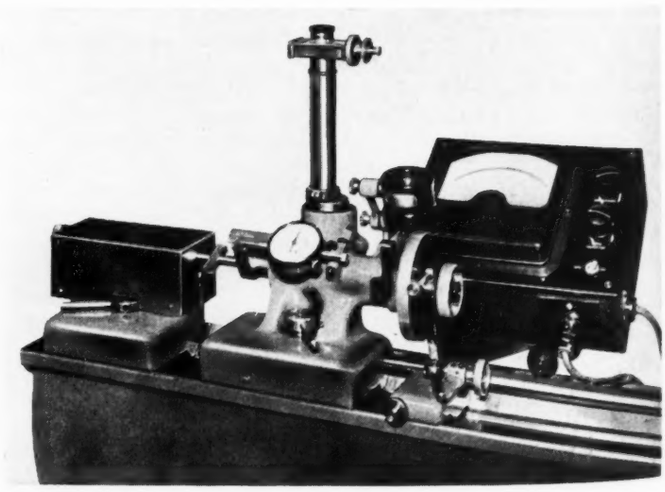
The purpose of this book is to tell the engineer how to design and build or how to buy an exhaust system that will adequately and economically perform the functions prescribed by the industrial hygiene expert or by law. Although exhaust ventilation has been practiced for more than seventy years and has been recognized by statute for more than forty years, the literature is astonishingly scanty. There seem to have been two major contributing factors: First, the field has been relatively small and inconspicuous and has not attracted the attention of colleges and other independent investigators. Second, many of those within the industry have treated their accumulated data as precious trade secrets to be divulged neither to competitors nor to customers. The author aims to dispel most of the mystery surrounding exhaust work and to express many of the trade secrets in straightforwarded engineering terms.

This book covers the following subjects: Flow of fluids; hood forms; air flow through hoods; pipe resistance; piping design; dust separators; low-pressure conveyors; centrifugal exhaust fans; structural details and system planning; field measurements and their interpretation.

* * *

The first Oldsmobile was built in 1897, and is now on display at the Smithsonian Institute, Washington, D. C. The first sixteen Buick cars were built in 1903. Production increased greatly during the following year, when thirty-seven Buick cars were built.

The measuring equipment shown to the right will indicate differences in measurements of a millionth of an inch. Such differences can be detected electrically through the recent application of a new General Electric gage-head to the tailstock of a Pratt & Whitney measuring machine in the General Electric Co.'s tool and gage department at Schenectady, N. Y. Originally, this machine was built to measure, mechanically, to one hundred-thousandth inch, gage standards up to 80 inches long, and to compare tool-room standards and factory gages, recording extremely small differences in dimensions.



NEWS OF THE INDUSTRY

California

QUIJADA TOOL CO., manufacturer of high-speed portable pipe machines, has recently moved from 620 N. San Gabriel Blvd., San Gabriel, Calif., into a new factory at 5474 Alhambra Ave., Los Angeles, Calif. An error was made in the announcement concerning the change of address of this company in December MACHINERY.

Illinois

W. A. BECHILL, of the Chrysler Corporation, DeSoto Division, Detroit, Mich., has been elected general chairman of the Automotive and Machine Shop Section of the National Safety Council, 20 N. Wacker Drive, Chicago, Ill. J. C. BOWER, of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., and L. G. SEATON, of the General Motors Corporation, Detroit, Mich., have been elected vice-chairmen.

MELL E. TRAMMELL, of the Republic Steel Corporation, Alabama City, Ala., has been elected general chairman of the Executive Committee of the Metals Section of the National Safety Council, having headquarters at 20 N. Wacker Drive, Chicago, Ill. H. J. GRIFFITH, of the Jones & Laughlin Steel Corporation, Pittsburgh, Pa., has been elected vice-chairman.

R. J. AITCHISON, president of Vascoloy-Ramet Corporation and Fansteel Metallurgical Corporation, both of North Chicago, Ill., has been elected a director of the Illinois Manufacturers Association.

Massachusetts

WALTER JEHU has been appointed district manager of the Timken Roller Bearing Co.'s Boston, Mass., office, located at 1107 Commonwealth Ave. Mr. Jehu was formerly general manager of the Timken Roller Bearing Co., Ltd., Toronto, Ontario, Canada.

Michigan and Wisconsin

V. H. DEARLE has been appointed assistant Detroit district manager of Carboloy Company, Inc., Detroit, Mich., manufacturer of cemented-carbide tools, dies, and wheel-dressers. Mr. Dearle has been with the company since its formation in 1928. He is a charter member of the American Society of Tool Engineers, and has been connected, in executive capacities, with the tool industry in Detroit for over thirty years.

GUNTHER A. JACOBS has been elected vice-president of the Firth-Sterling Steel Co., McKeesport, Pa. Mr. Jacobs will continue as resident manager in Detroit, and will make his headquarters at the company's new warehouse and sintered carbide plant at 8330 W. Chicago Blvd.

CHARLES BOND CO., 617-623 Arch St., Philadelphia, Pa., has appointed the F. RANIVILLE CO., 241-247 Pearl St., N.W., Grand Rapids, Mich., distributor for Bond stock gears and speed reducers.

HARNISCHFEGER CORPORATION, Milwaukee, Wis., manufacturer of overhead traveling cranes, hoists, excavators, and other material-handling equipment, announces the appointment of the KINGSPORT ELECTRIC CO., INC., Kingsport, Tenn., as exclusive agent for the sale of P & H hoists in that state. The Kingsport Electric Co. will operate under the direction of the Memphis office of the corporation. R. H. MCGREDY, for many years a sales executive of the corporation, has been appointed manager of the Washington, D. C., office. Mr. McGredy is now residing in Alexandria, Va., R.F.D. No. 1.

New York and New Jersey

LAKE ERIE ENGINEERING CORPORATION, Buffalo, N. Y., manufacturer of hydraulic presses and special machinery, is constructing an addition to its plant which will provide three times the present floor space for the engineering department and give increased room for other departments. Special attention is being devoted to adequate lighting by the use of glass on practically the entire outer wall area and by the installation of modern semi-indirect lighting equipment.

FRANCIS HODGKINSON, honorary professor of mechanical engineering at Columbia University, and former associate of George Westinghouse, was awarded the Holley Medal by the American Society of Mechanical Engineers at the annual convention of the Society, for "meritorious services in the development of the steam turbine." Mr. Hodgkinson was associated with the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., for forty years, retiring as consulting mechanical engineer in February, 1936.

HARVEY L. RAMSAY has been appointed sales promotion manager for the Porter-Cable Machine Co., of Syracuse, N. Y., manufacturer of industrial sanding machines and electric hand saws. Mr. Ramsay was sales manager of J. D. Wallace & Co., Chicago, Ill., for a number of years.

T. F. BARTON, district engineer of the New York district of the General Electric Co., Schenectady, N. Y., has been appointed assistant manager of the New York district.

WALTER B. STRONG has been appointed assistant general sales manager of the Worthington Pump & Machinery Corporation, Harrison, N. J. Mr. Strong was formerly manager of the corporation's export division. GEORGE GELLHORN, JR., will succeed him in the latter position.

BERNARD C. CASE has joined the staff of the Hanson-Van Winkle-Munning Co., Matawan, N. J., manufacturer of electroplating equipment and supplies. Mr. Case will devote himself to special sales work for the company.

Ohio

TOLEDO PRECISION DEVICES, INC., a subsidiary of the TOLEDO SCALE CO., Toledo, Ohio, has purchased the DEFIANCE MACHINE WORKS, Defiance, Ohio, manufacturer of drill presses and other machine tools. Hereafter the concern will be known as the Defiance Division, Toledo Precision Devices, Inc. The officers will be H. D. BENNETT, president; G. R. BENNETT, vice-president; W. A. FINK, secretary-treasurer; and DON W. CHAMPLIN, general manager.

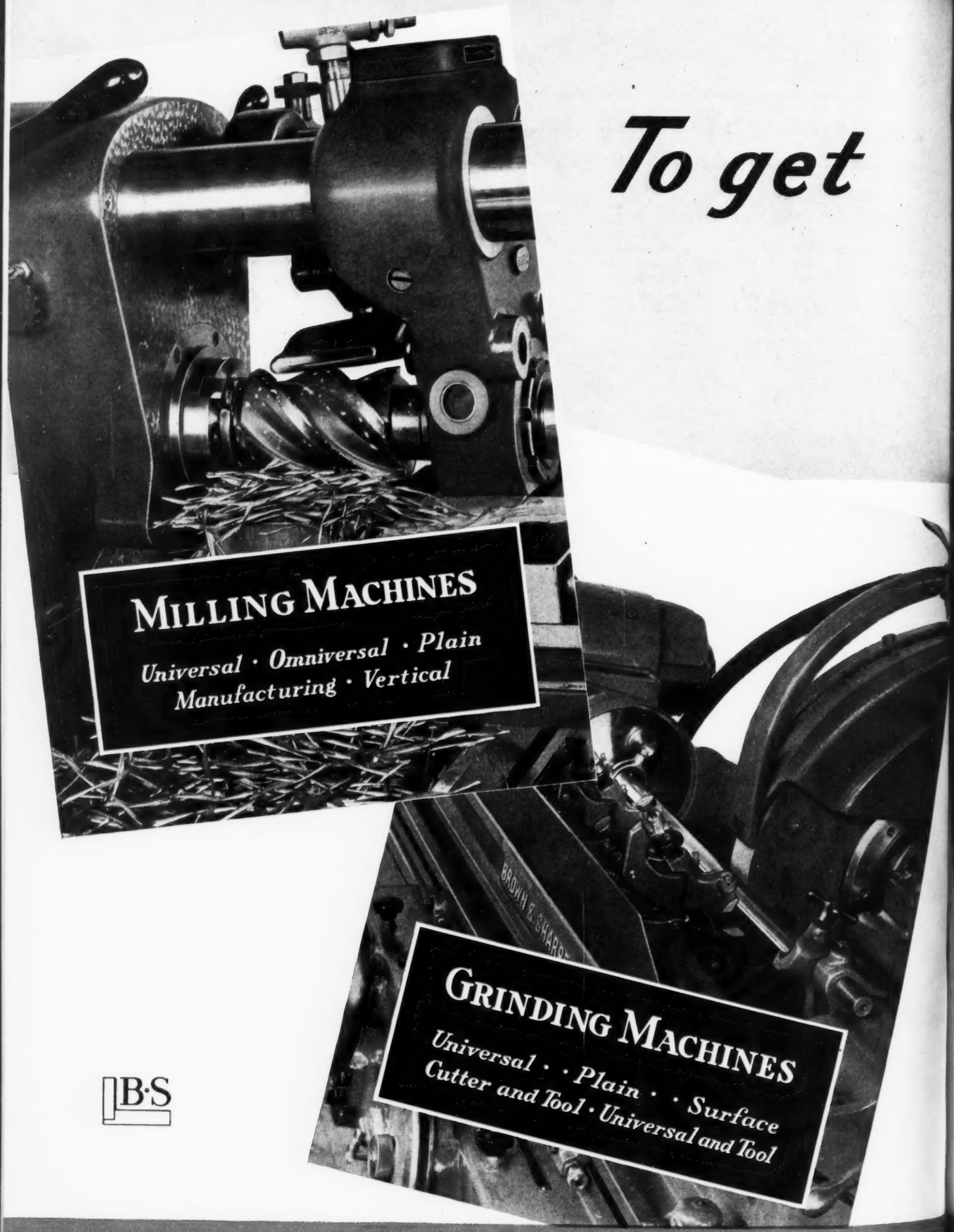
R. H. ZEILMAN has been appointed chief engineer of the Thew Shovel Co., Lorain, Ohio, and A. J. GILLESPIE assistant chief engineer. The Cleveland engineering department of the company has been removed to Lorain.

OILGEAR CO., 1301 W. Bruce St., Milwaukee, Wis., announces that its Cleveland representatives, E. C. Wollaeger and I. X. Calhoun, have moved to 3109 Mayfield Road, Cleveland, Ohio.

MONARCH MACHINE TOOL CO., Sidney, Ohio, manufacturer of lathes, is erecting a two-story office building which will add about 35,000 square feet to the area of the plant.

Pennsylvania

MCKENNA METALS CO., 147 Lloyd Ave., Latrobe, Pa., manufacturer of Kennametal tools and blanks for steel and metal cutting, announces that the company has licensed GEORGE H. ALEXANDER


To get
MILLING MACHINES
Universal · Omniversal · Plain
Manufacturing · Vertical
GRINDING MACHINES
Universal · · Plain · · Surface
Cutter and Tool · Universal and Tool
B·S
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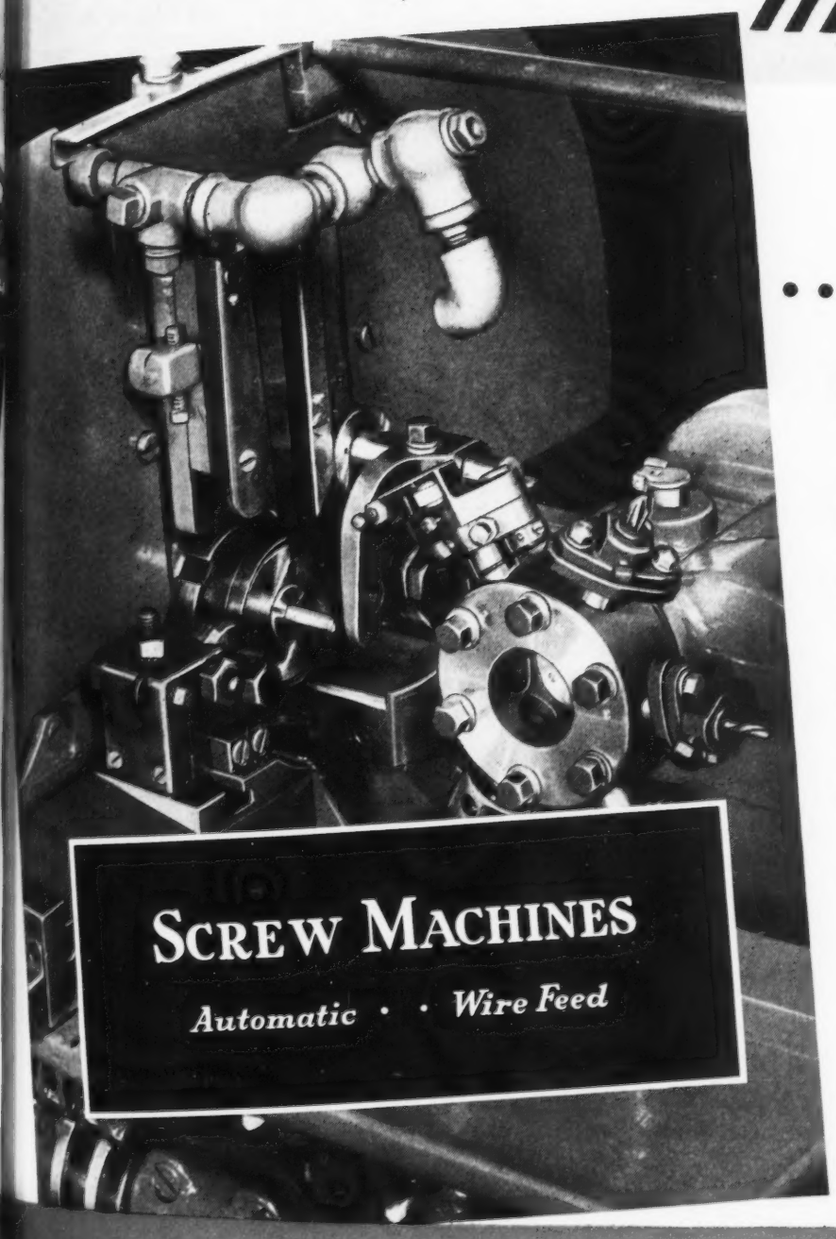
PROFITABLE PRODUCTION *in 1939*



· · · specify Modern Brown & Sharpe Machine Tools for original equipment and for replacement of old machines.

A wide variety of types and sizes available . . . catalog on request.

Brown & Sharpe Mfg. Co.
Providence, R. I., U.S.A.

SHARPE

MACHINERY, LTD., 82 Coleshill St., Birmingham, England, to sell Kennametal and fabricate tools from this metal in Great Britain and all British possessions, exclusive of Canada. Kennametal, a tungsten-titanium-carbide compound, is an ingredient used in the manufacture of hard carbide cutting alloys.

MARSHALL POST, vice-president and general manager of the Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa., and president of the American Foundrymen's Association, has just returned from a tour during which he addressed members of the Association in Detroit, Mich., Milwaukee, Wis., and Moline, Ill. Mr. Post's talks covered some of the important aspects of recent developments in the field of cast metals.

MEEHANITE METAL CORPORATION, Pittsburgh, Pa., has licensed the following companies to manufacture Meehanite metal: Valley Iron Works, St. Paul, Minn., Barnett Foundry & Machine Co., Newark, N. J., Herbert Morris, Ltd., Loughboro, England, Douglas Fraser & Sons, Ltd., Arbroath, Scotland.

COMING EVENTS

JANUARY 9-13—Annual meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at Detroit, Mich. John A. C. Warner, secretary, 29 W. 39th St., New York City.

FEBRUARY 23-25—Spring meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at St. Charles Hotel, New Orleans, La. C. E. Davies, secretary, 29 W. 39th St., New York City.

MARCH 5-13—LEIPZIG TRADE FAIR AND ENGINEERING EXHIBITION in Leipzig, Germany. For further information, address the Leipzig Trade Fair, Inc., 10 E. 40th St., New York City.

MARCH 8-10—Thirty-ninth convention of the INTERNATIONAL ACETYLENE ASSOCIATION at the Rice Hotel, Houston, Tex. For further information, address International Acetylene Association, 205 E. 42nd St., New York City.

MARCH 14-18—Annual meeting and MACHINERY AND TOOL PROGRESS EXPOSITION OF THE AMERICAN SOCIETY OF TOOL ENGINEERS at Detroit, Mich. Executive secretary, Ford R. Lamb, 2567 W. Grand Blvd., Detroit, Mich.

MAY 15-18—Annual convention of the AMERICAN FOUNDRYMEN'S ASSOCIATION in Cincinnati, Ohio. C. E. Hoyt, executive vice-president, 222 W. Adams St., Chicago, Ill.

MAY 28-JUNE 8—WORLD AUTOMOTIVE ENGINEERING CONGRESS to be held in New York, Indianapolis, Detroit, and San Francisco under the auspices of the Society of Automotive Engineers. John A. C. Warner, secretary and general manager, 29 W. 39th St., New York City.

JUNE 25-JULY 1—THIRTEENTH INTERNATIONAL CONGRESS OF CARBIDE, ACETYLENE, OXY-ACETYLENE WELDING AND ALLIED INDUSTRIES, to be held in Munich, Germany. For further information, address the International Acetylene Association, 30 E. 42nd St., New York City.

OBITUARIES

John E. Stetson

John Edward Stetson, treasurer and general manager of the Bryant Chucking Grinder Co., Springfield, Vt., died December 6 at the age of sixty years. While Mr. Stetson's health had not been good for several years, he was seriously ill for only about three weeks before his death.

Mr. Stetson was born in Hanover, Mass., in 1878, and graduated from Middlebury College in 1900. After graduation, he embarked on a teaching career, and in 1907, went to Springfield, where he was principal of the high school for three years. In 1910, he entered the employ of the Bryant Chucking Grinder Co. as secretary of the company. He became treasurer in 1913, and in 1931, was made general manager, which office, in addition to that of treasurer, he held until his death. He was also a director of the First National Bank of Springfield.

Mr. Stetson occupied an influential position not only in the machine tool industry, but also in educational and public affairs. He had a reputation for being remarkably fair in the consideration of any question, whether pertaining to public affairs or business. He would consider all sides of the matter and had an ability to sum up his conclusions in a few well chosen sentences.

Mr. Stetson is survived by his wife, his mother, and a sister.

Percy C. Day

Percy C. Day, vice-president and chief engineer of the Falk Corporation, Milwaukee, Wis., and prominent in the development of gearing and marine and rolling mill equipment, died December 7 at his home in Elm Grove, Wis. Mr. Day came to the United States in 1910 from England, where he had been a power plant engineer, and became associated immediately with the Falk Corporation. He was made vice-president in 1937. In England he was in charge of the West Drayton Gear Works of the Power Plant Co. for some years. He came here as chief engineer to direct the work of pioneering in helical and herringbone gearing in the United States. He was recognized as an authority on the design of helical gears.

Mr. Day graduated in 1894 from Central Technical College in South Kensington, England. The intervening years between graduation and association with the gear industry were spent performing pioneer work in the electric-metallurgical field, principally in developing electric furnaces and calcium carbide. He designed, built, and operated the first commercial plant producing this chemical in the British Isles. Other endeavors along this line claimed his attention until 1905, when he became interested in helical gears.

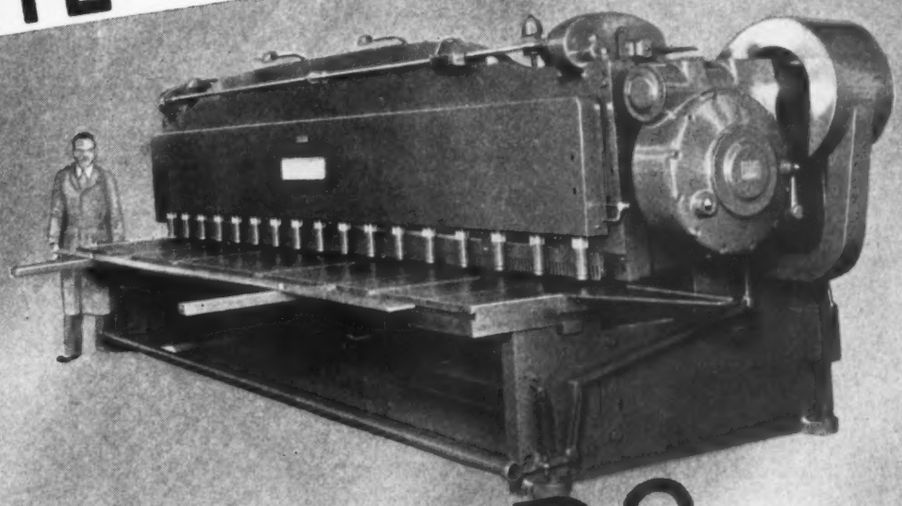
He had taken out a number of patents on gear equipment and large drives for rolling mills. Mr. Day was a member of the American Gear Manufacturers' Association, the American Society of Naval Engineers, and the American Society of Naval Architects.

HORACE B. SPACKMAN, retired vice-president of the Lukens Steel Co., Coatesville, Pa., died on December 11 of heart trouble, in his seventy-seventh year. Mr. Spackman was born in Caln Township, near Coatesville, on October 21, 1862. In 1881, at the age of eighteen, he was employed by the Lukens Steel Co. as an office boy. In 1892 he was appointed purchasing agent of the company. Five years later he was elected a director, and served in that capacity until his death. Mr. Spackman became a vice-president of the company in 1900 and retained that position until 1929, when he retired from active duty after more than forty-eight years of continuous service with the company.

WILLIAM A. WARD, assistant managing director of Thos. W. Ward, Ltd., Sheffield, England, died November 11 at his home in Sheffield. After having been educated at Cambridge and at Sheffield University, he served an apprenticeship in the engineering trade, and then began his career with Thos. W. Ward, Ltd., over thirty years ago. He became a director in the company in 1925, and in 1928 he was appointed assistant managing director. Mr. Ward was an engineer of wide experience and gave special attention to the company's machinery and engineering activities.

ERNEST DANA CROCKETT, a representative of Henry Prentiss & Co., Inc., of New York, for the last thirty years, died on November 24 in Springfield, Mass. Mr. Crockett was born in Monson, Me., on August 5, 1882, and graduated from Tufts College with an M.E. degree in 1905. His many years of association with the metal-working industry had given him a wide acquaintance in that field. He took an active part in civic and religious affairs in Springfield, where he had lived for the last twenty-five years.

SQUARE CUTS



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NEW BOOKS AND PUBLICATIONS

INDUSTRY'S OBLIGATION TO THE UNEMPLOYED. 39 pages, 6 by 9 1/4 inches. Published by the author, James W. Hook, President of the Geometric Tool Co., New Haven, Conn.

In spite of the social legislation that has been enacted with a view to solving the problem of unemployment, this question still remains one of our major difficulties. The present book contains abstracts of two addresses, in which the author outlined a definite program for industry in coping with unemployment. These addresses were made before the present legislation was enacted and were abstracted in November, 1931, MACHINERY.

At that time Mr. Hook pointed out that if industry did not solve the unemployment problem itself, the only alternative was government action, or compulsory unemployment insurance, which would probably force upon industry a disproportionate amount of the load. How true Mr. Hook's prophecy was subsequent events have shown. Not being content with generalities, Mr. Hook suggested a definite business-like program for industry involving the setting up of an employment reserve fund, contributed to by both employers and employes, in order to assure permanent income to the stable workers in industry during prolonged periods of depression.

Continuing requests for copies of these addresses have led the author to put them in permanent form. Those who believe that the present law is not the most effective method of solving the problem will find this book of considerable interest.

APPLIED TIME AND MOTION STUDY. By Walter G. Holmes. 325 pages, 6 by 8 1/2 inches. Published by the Ronald Press Co., 15 E. 26th St., New York City. Price, $3.75.

This book gives information on the new techniques that have revolutionized time and motion study and made it a practical means for cost reduction. The purpose of the book is to give the complete practice for making time and motion studies, interpreting the data obtained, and setting rates based on the time needed to perform the operation in question. All the data given is based on years of actual experience, the author being time study engineer with the Timken Detroit Axle Co.

Following a discussion of operating economy; what to study in improving operations; and economic conditions and methods, the book deals with the qualifications, working habits, and skill of the operator, and the nature and effects of fatigue. The qualifications and equipment of the analyst are also discussed. Then follows a detailed presentation of time study methods as applied in representative industrial concerns. The last six chapters of the book deal with motion study in which body member movements are analyzed and time values are determined. The exact times for performing all elementary motions are given, it is believed, for the first time in print.

GRINDING WHEELS AND THEIR USES. By Johnson Heywood. 374 pages, 6 by 9 inches. Published by the Penton Publishing Co., 1213 W. 3rd St., Cleveland, Ohio. Price, $3.

This handbook on modern grinding and polishing practice will be found useful by shop executives, grinding machine operators, and students in technical schools and colleges. It comprises a compilation of data contributed by many hundred men experienced in the grinding industry, and includes descriptions of various grinding practices and methods that have been found to be highly satisfactory.

Internal, cylindrical, surface, roll and cam, eccentric, and other out-of-round surface grinding are treated in separate chapters. The author discusses the materials used for polishing and buffing and explains how to set up polishing wheels. Throughout the book he stresses ways in which grinding output can be stepped up and the required finish imparted at the lowest over-all cost. Figures are cited to prove how much the use of better methods has increased production and reduced costs. Wheel recommendations for various types of grinding are presented in tabular form. The text is supplemented with data on the care and use of grinding wheels, wheel breakage and safety, and a glossary of trade names.

METAL COLORING AND FINISHING. By Hugo Krause. 222 pages, 6 by 9 inches. Published by the Chemical Publishing Co., 148 Lafayette St., New York City. Price, $5.

This book is a translation of a German work dealing with the latest practical methods for coloring and finishing metals of all kinds. It discusses the theoretical and practical applications, as well as patent angles of the subject of metal coloring by chemical, mechanical and electrical methods. An attempt is made to include all the important methods applied to iron and steel, as well as the base and noble metals in sheet, cast, mechanically fabricated, or electroplated forms. The book should be useful as a reference and guide book to those engaged in metal coloring for decorative as well as protective purposes. Many of the so-called secret processes of the electroplating art are described in detail with critical comments by the author.

FORGING PRACTICE. By Carl G. Johnson. 136 pages, 5 1/2 by 8 1/2 inches. Published by the American Technical Society, Drexel Ave. at 58th St., Chicago, Ill. Price, $1.50.

This book contains information on the hand-forging of wrought iron, machine steel, and tool steel, as well as on drop-forging and the heat-treatment of steel, including annealing, hardening, and tempering. The author of the book has had many years of experience, not only in practical work, but also in the field of instruction. He gives definite instructions, for example, on how to select various workable metals for specific purposes; how to determine the working temperature for different metals; how to weld by forging; how to use drop-forging methods; how to form shapes by the spinning of metals; and much other information along similar lines.

TIME-STUDY FOR COST CONTROL. By Phil Carroll, Jr. 305 pages, 6 by 9 inches. Published by the McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York City. Price, $3.

This book outlines, step by step, one method of completing the time-study measurement and control of cost without rearranging the shop. It concentrates on the preparation and use of standard data, as opposed to the costly process of individual-operation time-study. Not only does the method described permit of a much wider field of application, but the author also shows how it logically extends beyond simple incentive to form the basis for many managerial controls. The principles discussed have been tested by the author's extensive experience in time-study work.

FORMULAS FOR STRESS AND STRAIN. By Raymond J. Roark, Professor of Mechanics, University of Wisconsin. Published by the McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York City. Price, $3.

The purpose of this book is to present a compact, adequate summary of the formulas, facts, and principles pertaining to the strength of materials. Modern engineering trends have demanded more accurate methods of stress analysis, and these methods are covered here. The book is intended primarily as a reference work for designing engineers. Analytical and experimental methods of stress analysis, behavior of materials, and structural elements are among the useful data included.

THE INFLUENCE OF FORM AND SCALE ON STRENGTH. By Raymond J. Roark, Richard S. Hartenberg, and Rex Z. Williams. 55 pages, 6 by 9 inches. Published by the University of Wisconsin, Madison, Wis., as Bulletin No. 84 of the Engineering Experiment Station.